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JUN 15 1934

June 14, 1934

Engineering News-Record

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Editorial Staff
V. T. Boughton
W. G. Bowman
C. S. Hill

Chicago
W. W. De Berard

McGraw-Hill Publishing Co., Inc. Editorial and Publishing Offices: 330 West 42d St., New York

F. E. SCHMITT, *Editor* WILLARD CHEVALIER, *Vice-President*

Editorial Staff
F. W. Herring
H. W. Richardson
J. I. Ballard

San Francisco
N. A. Bowers

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In the News:

DURING THE WEEK NRA abandoned its policy of fostering price-fixing agreements in *new* codes and modified open-pricing methods to the extent of having prices listed confidentially with an NRA agency only. General Johnson, NRA Administrator, says the rulings are not mandatory on existing codes, so that changes for steel, cement or lumber are not an immediate prospect.

BOTH HOUSE AND SENATE passed the Cartwright Bill last week, and it now rests with the President whether the bill becomes law or not. It not only provides for a $200,000,000 federal expenditure in 1935 but for $125,000,000 in 1936 and 1937, which must, in these years, be matched in like amount by the states.

DROUGHT-RELIEF PLANS of the Administration contemplate an expenditure of $525,000,000, of which about $100,000,000 is destined for work relief and $50,000,000 for the CCC in the areas affected. Well-digging and road repair are included. Administrator Ickes has instructed PWA forces to expedite projects in the drought states. He mentioned the Casper-Alcova dam and reservoir in Wyoming, the Fort Peck Dam in Montana, upper Mississippi River work, highway work and Nebraska power projects on the Loup and Platte Rivers.

OPENING of the Dotsero Cutoff, scheduled for next Saturday, provides a new trans-Rocky Mountain railway route to the Pacific Coast, connecting Denver with Salt Lake City via the Moffat Tunnel. Both the Burlington and the Rock Island are said to be planning to use the new line.

WATER TANKS erected on Chicago buildings prior to the enactment of the present building laws in 1917, which required filing of plans, must be inspected by a competent engineer and the report filed with the city building commissioner, according to a ruling of last week. The failure of a tank two weeks ago, resulting in the death of five persons, called attention to the potential danger in these old structures.

NEW YORK CITY is working toward a new deal in municipal government. Governor Lehman has announced a special session of the legislature, to convene early in July, to consider a constitutional amendment permitting reorganization, consolidation or abolition of county offices. Ex-Governor Alfred E. Smith, chairman of the New York City Charter Commission, who asked for the special session, characterized the county organizations as "wasteful and inefficient."

BUDGET-MAKING has occupied the various construction code authorities for the past few weeks. So far, the budget for the master code authority and for five divisional authorities—general contracting, electrical contracting, elevator manufacturing, tile contracting and painting and paper hanging—have been submitted to NRA, which has announced that objections must be filed prior to June 18.

THE PLANNING AND ADJUSTMENT BOARD for the construction industry, one of the most important agencies created by the construction code, has its personnel complete with the appointment by the President of Sullivan W. Jones, former New York state architect and NRA Industrial Advisory Board head in Washington, as impartial chairman.

In this Issue:

RUSSIA has created a great laboratory for hydraulic research by centralizing and coordinating eleven existing and nine newly created laboratories in an organization known as the Scientific Research Institute of Hydrotechnics. It is the largest hydraulic research institution in the world, and its studies of models are as remarkable as those being made in this country at the U. S. Waterways Experiment Station at Vicksburg, Miss.

BUSINESS DEALINGS with federal government agencies on the part of contractors have greatly increased in the past year or two. The attitude of these agencies toward errors in bids is outlined in an article in this issue.

NEW HARBOR IMPROVEMENTS at the Port of Havre are of striking character. Four types of modern quay construction include solid and hollow walls, arch spans and a trestle design with precast members. At the harbor entrance three concrete caissons, said to be the largest ever floated and sunk, have been installed; and 2½ miles of sea embankment have been placed to inclose the outer harbor. An article in this issue describes these interesting structures. A previous article (*ENR*, May 24, 1934, p. 651) outlined the general scheme of harbor improvement at this important port.

CONSTRUCTION and maintenance practice for stabilized-soil roads is the subject of the third article in this series. Based on tests and experience, it has been shown that construction procedure, while simple, is definite and not rule-of-thumb. Maintenance suggestions are based on practices in Michigan.

THIN CONCRETE SHELL ROOFS developed and used extensively in Europe have a counterpart in one of the new World's Fair buildings at Chicago. Heavily reinforced and constructed with the use of concrete vibrators, the roofs are a distinct innovation in this country.

A BADLY TILTED suspension-bridge tower on a 450-ft.-span bridge over the Rio Grande was righted and set on a new pier early this year. The procedure by which this unusual repair job was carried out is outlined by the engineer in charge.

THE A.W.W.A. CONVENTION last week was featured by a session devoted to detailed discussion of the dysentery outbreak of last year. Other sessions covered the many other subjects that are of current and continuing importance to water supply and purification.

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ENGINEERING NEWS-RECORD

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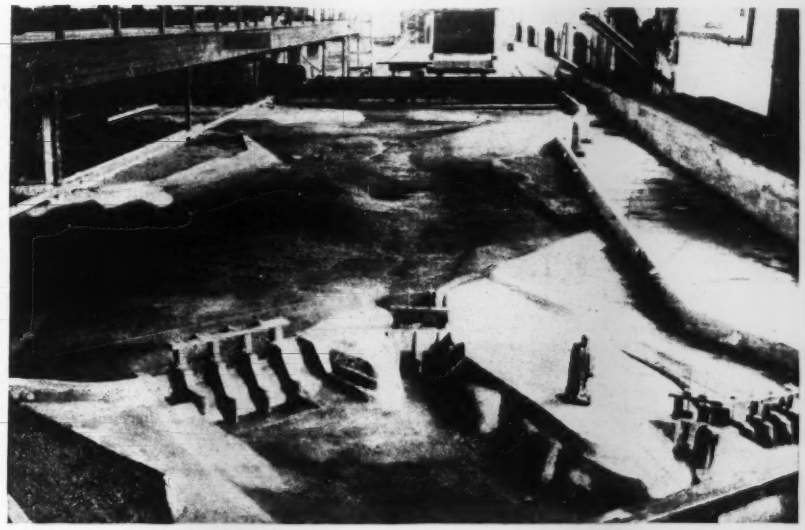


MOVABLE-BED MODEL, 52x20 ft., of Zemo-Avchali project indicates typical experimental model layout used in Russian hydraulic research.

Russia Creates a Great Laboratory For Hydraulic Research

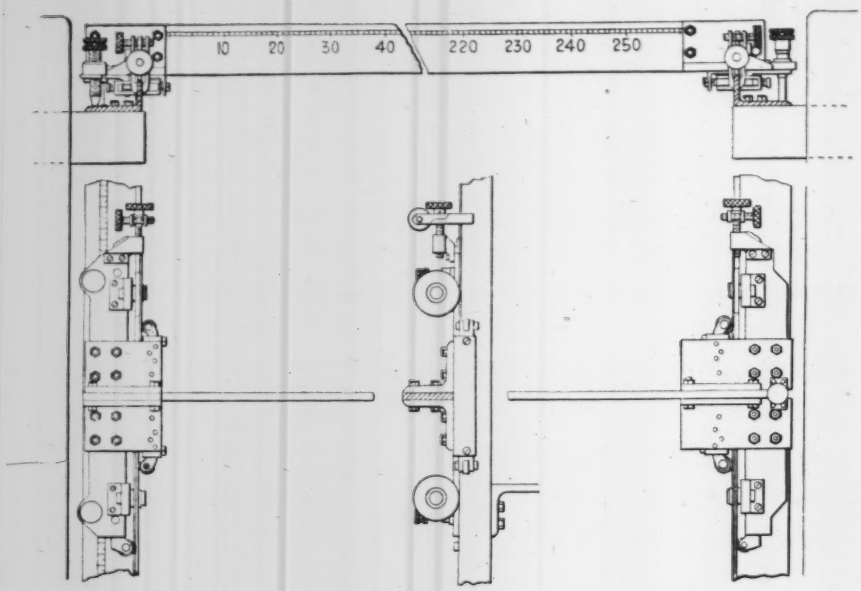
Eleven existing and nine newly created hydraulic research laboratories centralized and coordinated in the Scientific Research Institute of Hydrotechnics with a great central laboratory at Leningrad

By I. Gutmann

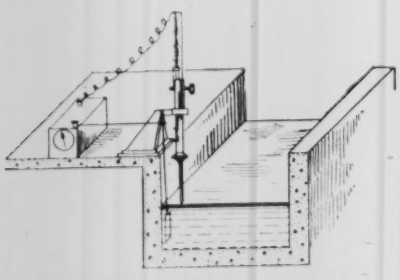
Associate Editor, Engineering Index, New York, N. Y.

NOW THAT the Union of Soviet Socialist Republics is recognized by the government of the United States and normal friendly relations between the two republics are being resumed, it may be timely for American engineers to reach out for a closer acquaintance with the achievements of their Russian colleagues during the recent years of feverish work for the industrialization of their country. This article will review but one definitely limited branch of Russian engineering research: laboratory and field experimentation in hydraulic engineering—a line of research which is at present also a subject of lively interest and considerable activity in this country.

In U.S.S.R. the bulk of hydraulic experimentation is conducted in a centralized and coordinated manner in a government organization known as The Scientific Research Institute of Hydrotechnics, which is the largest hydraulic research institution in the world. It was organized at the beginning of 1931 as a merger of six large hydraulic research institutes and a number of smaller hydraulic research units affiliated with various government trusts, colleges and engineering projects, among them the well-known Land Reclamation Institute (Scientific Melioration Institute), the hydraulic laboratories of the Institute of Electrical Engineering, the Institute of Construction, the School of Structural Engineering and the Svirstroy Hydro-electric development—a total of eleven fully equipped hydraulic laboratories. Later the new institute constructed a laboratory building at the Leningrad Forestry Institute, housing nine new research laboratories, thus raising the total to twenty fully equipped hydraulic research laboratories. The staff consists at present of 421 men and women, among them 150 scientifically trained technicians, engineers and professors. The annual appropriations for the institute have steadily grown from 920,000 rubles in 1931 to 2,192,000 rubles in 1932 and to 2,520,000 rubles in 1933. For compari-



CROSS-SECTIONING DEVICE for determining movable-bed and water-surface contours in model test channels.



WATER-LEVEL INDICATOR in which water contact with pointer closes electric circuit giving reading on vertical scale.

son, it may be recalled here that the U. S. Waterways Experiment Station at Vicksburg, Miss., which is the greatest institution of its kind on the American continent, has a staff of 140 men and women, 70 of whom are engineers and engineering aids. Its annual expenditures are estimated at about $215,000.

The institute is organized in six special divisions or sectors, as they are called in the militant language of the Soviet Union: (1) hydraulics and hydraulic structures, (2) hydro-electric power, (3) hydraulic design, (4) investigation of existing structures, (5) ice engineering, (6) special hydraulic problems.

Besides its several laboratories for the study of the general problems of hydraulics and hydro-electric power development, the institute also comprises a number of special units: a water percolation laboratory, two soil physics laboratories, a hydrological laboratory, a groundwater laboratory, a hydraulic machinery laboratory, a laboratory for the study of materials of hydraulic construction, a motion-picture laboratory and a special calibrating and rating station.

All these units, which are located in and around Leningrad, are devoted both to the general promotion of hydraulics and to specific practical service to the many hydro-electric, irrigation, waterways, mining and petroleum transportation projects scattered all over the vast union of the Soviets from the Hungry Steppe in Turkestan to the Baltic Sea and from the Persian border to the Arctic Circle.

In connection with this latter phase of its work the institute has a traveling staff of experts and technicians, provided with mobile equipment, organizing and supervising the work of special indoor and outdoor experimental laboratories located at the sites of the various projects, plants and developments.

Practical service planned

When the project is completed, the institute may again be called upon to maintain a sort of tutelage and supervision over the routine and emergency operation of the project. So, you may find the institute guiding irrigation projects in Bokhara and in Armenia in matters of silt control in canals and storage reservoirs, while combating ice troubles in the operation of a hydro-electric power system near the Polar Circle. This of course involves the services of traveling staffs, possibly the establishment of outdoor field laboratories, besides research at the central laboratories in Leningrad.

The proportional relation of the activities of the institute, in the practical service of hydraulic projects, to its more general research work, is shown in the accompanying tabulation.

Thus we see that the institute is rapidly becoming more and more of a service organization for the construction and operation of hydraulic enterprises. This evolution in the direction of practical utilitarian service marks a certain crisis in Russian engineering tradition. In Russia, engineering has been a rather genteel profession with a considerable tendency to theorization, sometimes fruitful and often sterile. Even in these days of unprecedented rush in construction you may come across Russian engineers, not necessarily advanced in age, who will admit with ill-disguised satisfaction that in designing a reinforced-concrete girder they start out with some 26 independent equations. Approximate formulas, tables and charts, used so much by American engineers, are still considered by some Russians as products of rather vulgar "standardization" and "rationalization," systems devised for an intellectually weaker species of engineers.

Bearing this in mind, one may appreciate the somewhat apologetic statement of P. N. Provorov, director of the institute, justifying hydraulic experimentation. Provorov asserts that, in designing hydraulic structures on the basis of laboratory experiments, we admit the inadequacy of existing theoretical methods of design, yet laboratory experimentation must be developed with greater intensity, not only in order to work out approximate solutions for urgent practical problems but also in order to stimulate the progress of theoretical methods, which, after all, are more powerful, more effective and, of course, cheaper. Hydraulic experimentation is indispensable because practice is far ahead of theory; nevertheless, in planning a set of experiments one must start out with a guiding working theory duly representing the essential physical nature of the phenomena studied. This is a fundamental rule of the institute which unfortunately cannot always be adhered to, but the ideal remains: experiments must be planned in strictest accord with the latest results of physical science.

With the conflict between loyalty to theory and practical necessity thus resolved, Russian hydraulic engineering has gone experimental, strongly so.

Model tests stressed

It would seem that not a single important step is taken in hydraulic construction without being subjected to thoroughgoing laboratory tests by means of models. So, in connection with the

DISTRIBUTION OF ANNUAL EXPENDITURES OF INSTITUTE

Year	Total Expenditure, Rubles	Distribution of Total Expenditure For General Research Per Cent	For Research in Service of Enterprises, Per Cent
1931	920,000	91	9
1932	2,192,000	70	30
1933	2,520,000	43	57

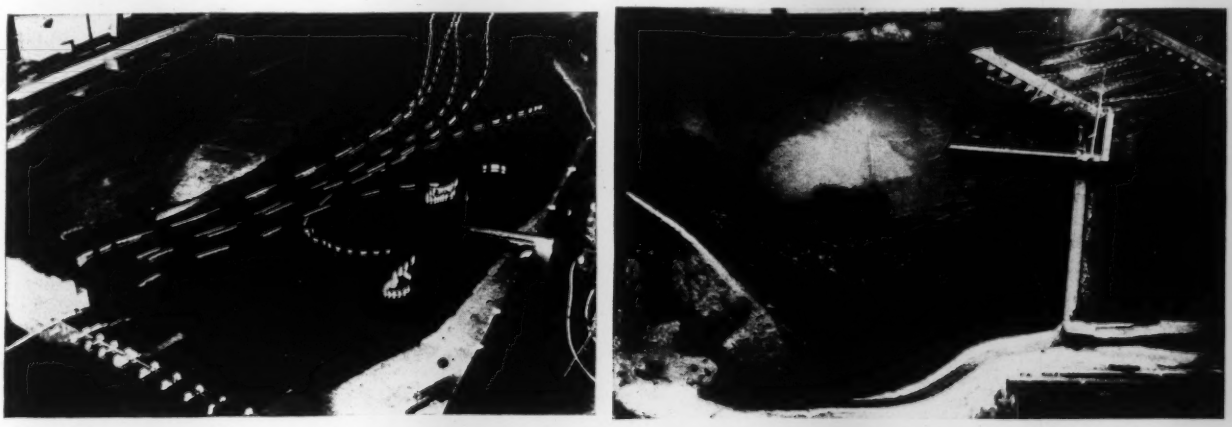
construction of the Svirstroy hydro-electric and navigation project, more than twenty sets of model tests were made at Hydro-technical Laboratory No. 1 of the Leningrad Institute. Among these were the following:

1. Selection of type of stilling structure for sluices under normal operating conditions.
2. Checking of operation of stilling structure selected under temporary conditions obtaining during second phase of construction.
3. Determination of water pressure on gates of scouring sluices.
4. General hydraulic configuration of headworks.
5. General hydraulic configuration in forebay.
6. Discharge of ice load through plant.
7. Determination of shape and volume of excavation in riverbank.
8. Determination of length of division piers on crest of spillway section of dam.
9. Hydraulic problems in construction procedure following completion of first series of cofferdams.
10. Checking these laboratory studies in field.
11. Study of hydraulics of construction procedure in second phase of project. First scheme.
12. Same for second scheme.
13. Study of problems in connection with power delivery to Leningrad industries in advance of schedule.
14. Seepage characteristics of 30 types of fill for right-shore embankment.
15. Seepage through model of right shore embankment for various inclinations of downstream slope. First scheme: impervious foundation.
16. Same for second scheme: pervious foundation.
17. Same for third scheme: mixed type of foundation.

Of similar model studies made by this laboratory in connection with the construction of waterways, irrigation and hydro-electric projects, a few of the most interesting ones should be mentioned here:

Discharge of overflow arch dam.
Checking of suctionless profile of steep wasteway.
Model testing of siphon spillway combined with stilling structure.
Comparative study of two designs of tunnel spillway.
Design of composition of clay membrane for earth dam.
Comparative tests of nine schemes of cofferdams for construction of hydro-electric power plant north of Polar Circle.
Tests of methods of construction of rockfill dam by dumping rock into streams.

Of course, equally interesting and important studies, both specific and general, were made at the other laboratories of the institute. The Hydro-Electric Laboratory, under the direction of Prof. I. G. Egiazarov, has to its credit an interesting study of surface curves upstream and downstream of gates and turbines (negative and positive waves), control of scouring and silting at headworks, and experimental design of surge tanks. Hollow pivoted lens-shaped gates with liquid or solid ballasting were studied at the so-called Hydraulic Laboratory 1, following a design proposed by Prof. V. G. Gebel. An original type of fishway was developed at the Laboratory of Soils and Hydraulic Structures, directed by Prof. N. P. N. Puzyrevsky. However, the specialty of this laboratory is earth structures, such as earth dams and embankments. The staff of this laboratory is responsible for the design of an overflow earth-and-rock-fill dam in which the energy of the overflowing water is dissipated within the downstream rock-fill of the dam. They also developed a rational design for coarse pervious railroad and highway embankments to take the place of bridges or culverts.



LUMINOUS FLOATS are used quite generally in the testing work. At the left they are shown in a model of the forebay and sand traps of the Adjaris-Zahli project. At the right they are being used in testing one of the models of the Svirstroy project.

Original research instruments

It is hardly necessary to describe the laboratories of the institute. Suffice it to say that they are up-to-date, well-planned and efficiently designed institutions with modern standard equipment, including glass flumes, time recorders, gages of the highest precision and rather uncommon combined motion-picture and microphotographic apparatus. It will not be amiss, however, to give a few brief notes on original Russian apparatus and technique evolved in these laboratories. Hydro-technical Laboratory 1 uses the following:

1. An electrical set-up for the precise measurement of comparatively high stream velocities. It consists of four electric chronometers, recording to 0.01 sec., and of a relay unit. The surface floats used in connection with this outfit are provided with very flexible thin steel rods projecting vertically upward. These rods, when passing certain points of the testing flume, come in contact with wires stretched across the flume at these points, whereupon they close an electric circuit and set off or stop the electric chronometers mentioned before.

2. Electric water-level indicator. This apparatus essentially consists of a stationary point gage which, upon first contact with the water surface, immediately closes an electric circuit that comprises a milliammeter. The deflection of the pointer of this milliammeter signals contact of gage point with water surface, whereupon reading on vertical scale is recorded. Readings taken by this method are practically free of observer's personal equation. This level indicator has amply proven its precision both in laboratory and in field.

3. Cross-sectioning gage. This installation, used on one of the laboratory flumes, consists of a graduated steel lath, 2.8 meters in span, mounted on roller carriages at either end, traveling along rails on top of flume walls. A point gage is attached to a sleeve sliding along the graduated lath, perpendicularly to the axis of the flume. Positions of both lath and point gage can be accurately set by means of vernier micrometers. The exact horizontality of the lath is maintained by means of leveling screws. Practice has proved that with this installation it is possible to determine the elevation of any point on the surface of the water in the flume to within 0.1 mm., i.e., 0.00033 ft.

An ingenious battery of twenty electric recorders was installed along the main flume (246 ft. long) of the Hydroelectric Laboratory under the direction of Prof. I. V. Egiazarov. The scope of this article does not permit us to go into the details of these interesting instruments, each one of which records the fluctuations of one or more captive floats.

Photographic recording

The use of floats for observing the paths and velocities of water currents has been perfected to a remarkable degree of efficiency. The introduction of luminous floats for the observation of surface currents is particularly noteworthy. Drifting luminous floats, when photographed with an anastigmatic camera whose shutter is electrically controlled by means of a pendulum of known period, appear on the negative as a series of broken lines, consisting of dashes. These lines represent the traces of the drifting luminous floats. Each dash, plus one of its adjacent gaps, represents the distance traveled by the float during one full period of the pendulum controlling the shutter of the camera. One or more graduated rules placed along the flume and photographed together with it serve as the graphical scale of the photograph. Of course the graphical scale of the photograph can also be obtained by setting marks on the flume walls at certain regular or irregular intervals. Now, knowing the scale of the photograph and the period of the pendulum, we can easily compute the velocity of the float practically at any point of its path.

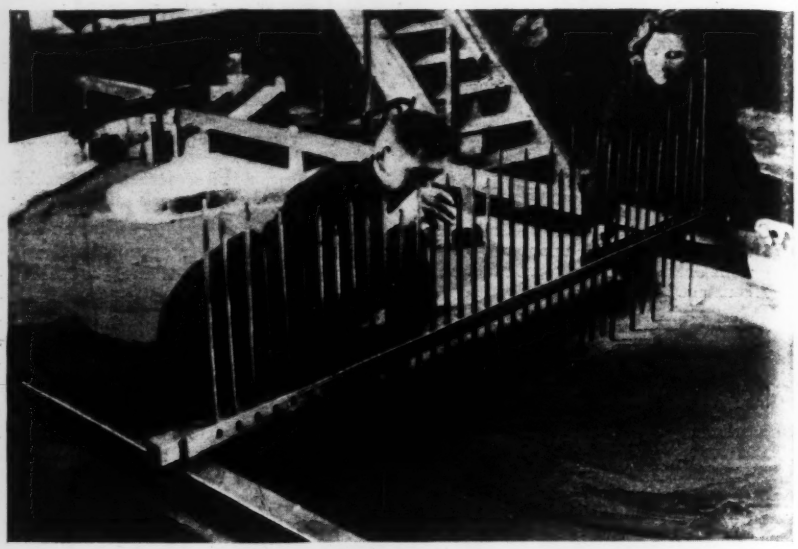
This method of graphical recording of float runs is sometimes modified as follows: The camera is not used to photograph the path of the float, but an observer stationed back of the camera sketches in the path of the luminous floats with a pencil on the ground glass of the camera. The record on the ground glass can be later copied on tracing cloth. Of course it is desirable to use large cameras; the Leningrad laboratories use a camera giving a 30x24-cm. negative (11.8 in. by 9.45 in.)

A useful pictorial record of flow may also be obtained in the following manner: The stream is sprinkled with coarse white dry sawdust, a strong light is thrown upon it from reflectors, and a photograph is taken.

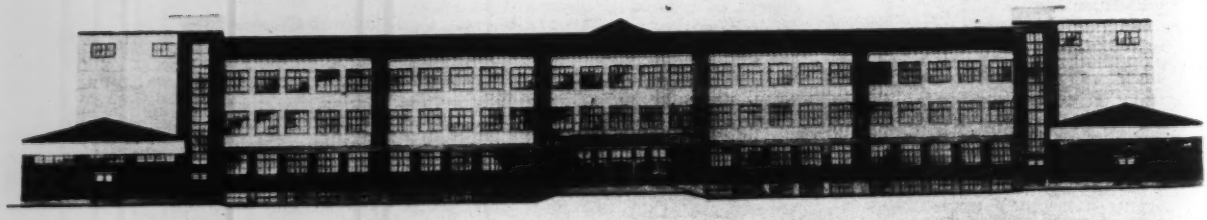
The same photographic methods can be used also for the study of subsurface flow. Of course, this requires subsurface floats of special design, usually hollow gypsum spheres, or hollow glass spheres silvered on the inside, which are weighted with bits of wax to keep them suspended in the stream. These floating spheres, which are generally about 10 mm. in diameter, are of comparatively low visibility, being sometimes submerged in several inches of water, and they have to be followed with a strong spotlight when their photograph is being taken. The selection of the proper intensity of the spotlight is not an easy matter at times, particularly at low velocities of flow. Refraction is not a disturbing factor when the depth of the stream is small, and its distance from the objective of the camera is large enough. For depths exceeding, say, 4 in., it may be necessary to correct for refraction.

Photography and sketching on ground glass are also useful in recording movements of bed material, erosive processes, etc. Plain glass covered with tracing cloth can be substituted for ground glass, and sketching can be done directly on tracing cloth.

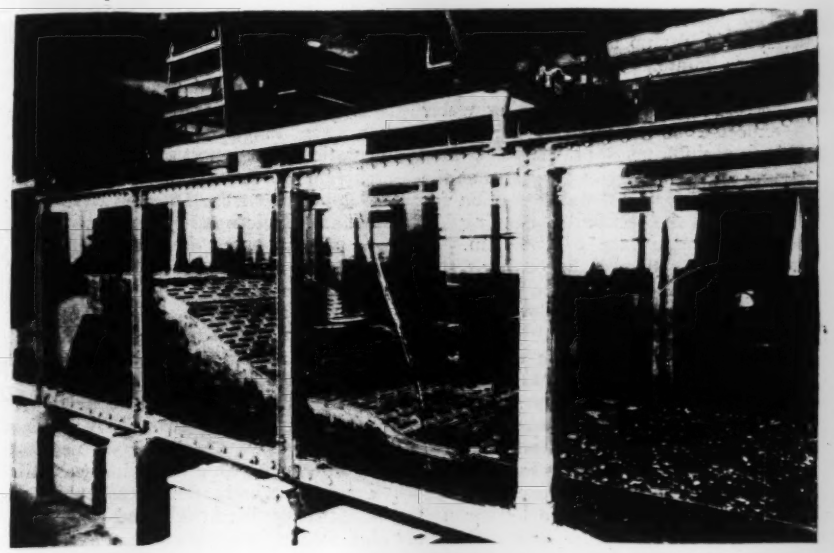
Images obtained by these methods may be considered for all practical purposes as free from distortion, provided the camera is equipped with an anastigmatic lens and all other proper precautions have been taken. With the objective of the camera at a distance of 10 to 13 ft. vertically above the mean elevation of the model, the surface of the model can, under usual laboratory conditions, be considered a horizontal plane. When the model represents a sharp drop in elevation, as for example in the case of an overflow dam, the upstream and downstream sections will have to be photographed separately, or separate appropriate scales will have to be used when evaluating the data of the photograph. Experience has shown



MEASURING SILT-DEPOSIT VOLUME and cross-section by adjustable needle templet.



LABORATORY BUILDING of the Scientific Research Institute of Hydrotechnics of the Russian government.



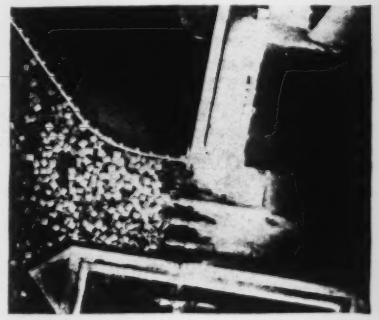
OVERFLOW DAM MODEL for Tikhaya River earth-and-rockfill dam showing concrete protecting grid.

that the errors inherent in this process are not greater than the intrinsic errors of float observations, and with proper care the total resultant errors of the photographic method need not exceed 1 per cent, which is quite satisfactory at the present stage of hydraulic laboratory technique.

Electro-hydrodynamical analogy method

Prof. N. N. Pavlovsky's "method of electro-hydrodynamical analogy" is a powerful research tool of great promise for the study of the movement of water under weirs, dams and similar structures built on pervious foundations. Its principle was first stated in 1920, a Russian book on it was published in 1932, and finally in 1934 it made our own *World Almanac* (p. 158) as one of the first items in the list of the year's outstanding engineering achievements; still, it is barely known outside of the Soviet Union.

Briefly stated, this method is based on the observation that the flow of water through the cross-section of a uniformly pervious medium and the flow of an electric current through a tinfoil sheet are determined entirely by the geometrical shape of the planes in which the flow occurs, when the coefficients of percolation and conductivity, head and voltage are each equal to unity. This being so, amperage and voltage measurements on a tinfoil sheet geometrically homologous with the shape of the cross-sectional plane of a pervious foundation substratum, when properly converted, will indicate the distribution of water pressure in that stratum and the rate of discharge through it. This method is, in fact, a further generalization and extension of the principle of similitude and the theory of model testing, substituting an electric current for a stream



MODEL ICE-GORGE STUDIES made with wood blocks to represent ice cakes.

of water and an electric conductor for an underground channel. Thus the similitude aspect of prototype and model is restricted to geometrical shape and nature of flow. The scheme of the electrical apparatus used in this method is shown in an accompanying illustration.

The Scientific Research Institute of Hydrotechnics organized a special laboratory for the development and application of the method of electro-hydrodynamical analogy. B. F. Reltov is investigating the application of radio apparatus to this method, and V. I. Davidovich studies the use of the method in the investigation of percolation through three-dimensional systems —more specifically, such phenomena as seepage around dam abutments.

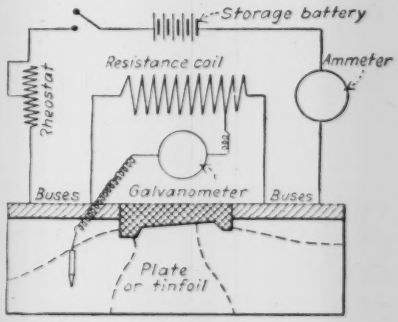
At this laboratory the electro-hydrodynamical method was successfully used for checking and improving the designs of some nine weirs and rockfill and earthfill dams up to 69 ft. in height, all of them on pervious foundations. As many as 200 electro-hydrodynamical tests were made in connection with only one of these dams, in which a diversity of natural conditions suggested a great number of possible variations in the design of aprons, cutoffs, drainage wells, etc. A similar study on another dam, involving sixteen electro-hydrodynamical model tests, led to the determination of the proper length of the upstream apron and clearly demonstrated the redundance of a cutoff at the upstream end of this apron as a check to percolation. Valuable general deductions were drawn from these numerous tests, some of which are at considerable variance with accepted practice based on theories developed by Bligh and others.

The method of electro-hydrodynamical analogy is particularly helpful in the case of irregularity in the underlying strata or in the structures. Such difficulties as the presence of irregularly shaped lenses of impervious materials or of water veins in the alluvial substratum, which are practically insurmountable with theoretical methods and can hardly be reproduced in models without going into heavy expense, are easily and quickly investigated by the electro-hydrodynamical method.

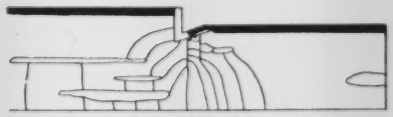
The method is equally cheap and efficient in the study of the effect of cracks and gaps in aprons upstream of dams. In 1931 the laboratory made about 200 tests in the study of this problem alone. The method was also used in the study of percolation through the body of earthfill dams. A series of 50 tests was made to determine the effect of wooden cutoff piling of various depths.

Soil studies for dams

Important work of great interest is also being done at the Laboratory of Soils and Hydraulic Structures under the direction of Prof. N. E. Puzyrevsky. The specific methodology of this laboratory also developed around an original invention of its director, namely the Puzrevsky apparatus for the determination of the angle of internal resistance of soils.



APPARATUS for tests by electro-hydrodynamical analogy.



EQUAL PRESSURE LINES in pervious foundation with impervious lenses obtained by electro-hydrodynamical analogy method.

The laboratory specializes in the study of earthfill and rockfill embankments and dams. One of its most remarkable achievements is the development of an overflow type of earth-and-rockfill dam. A dam of this type, 33 ft. high, is being constructed on the River Tikhaya, having a recorded floodflow of 16,000 sec.-ft. About 9,000 sec.-ft. of this floodflow will be taken care of by a tunnel spillway, while the remaining 7,000 sec.-ft. will discharge over the 360-ft. crest of a dam built of loam and rockfill. The upstream half of this dam is being built of a loam fill, sloped 3 on 1, having its upper two-thirds protected with a paving of rock resting on a layer of sand. The downstream half, separated from the upstream half by means of a rubble wall 9 to 36 ft. thick, consists of a coarse rockfill resting on a layer of moss and broken stone.

The downstream face of the dam will be protected with a heavy riprap of stone blocks up to 4 tons in weight. A heavy jointed concrete grid may be used instead of the downstream riprap blocks. Part of the overflowing water is expected to go through the downstream rockfill mass of the dam, thus giving up its energy of flow and at the same time creating a water cushion for the part of the discharge running off the downstream face of the dam. A model of this dam was thoroughly tested at the Soils and Hydraulic Structures Laboratory for various volumes of flow.

The laboratory also made an interesting research on the rational design of coarse rockfill embankments to take the place of railroad bridges and culverts. This type of embankment, which probably originated in British India and is now being used in inaccessible regions in U.S.S.R., is designed to let through considerable volumes of flow without being washed out. Valuable work was also done in the experimental study of various types of impervious clay diaphragms for earth dams.

It may be wondered why no mention has been made of hydraulic experimentation in connection with the construction of the famous hydro-electric development on the Dnieper River—the so-called Dnieprostroy. That project was amply tested in its time in the hydraulic laboratory of the Central Aerodynamical Institute of U.S.S.R., which is another remarkable research organization, having a staff of more than 500 scientists and engineers employed in its activities.

The author gratefully acknowledges his indebtedness to Prof. I. V. Egiazarov, director of the Hydro-electric Laboratory, Leningrad, who was kind enough to supply the photographs accompanying this article and other valuable data.

Errorless Bids Assumed in Federal Contracting

Federal contracting agencies not guardians for contractors—Errors in bids held due to bidder's negligence, for which he bears the cost

By Howard L. Jones
Cherrydale, Va.

THE FOLLOWING ARTICLE is the second of several, the first of which was published in *Engineering News-Record*, March 15, 1934, p. 360, which will discuss various aspects of contractual practices and policies in federal construction. Contractors can regard these articles as being penned with the knowledge that lends almost official authority to the statements contained in them. With numerous federal public works now in progress and to be placed under contract, these reliable interpretations of official decisions and procedure by federal contracting agencies have great practical usefulness. —EDITOR.

IT IS a provision of law that bids shall be advertised for in the procurement of supplies and services for the United States. This law was enacted to give all concerns an equal opportunity to compete for government business, to secure to the government the benefits that flow from competition and to prevent favoritism, collusion and fraud in the procuring of supplies.

To give effect to the law, it has been necessary for accounting officers and the courts to lay down hard and fast rules to be followed in advertising for supplies and awarding contracts. There can, obviously, be no partiality in awarding contracts. The article required by the government must be fully described as to design, quality and structure in the advertisement for bids. The lowest bid of a responsible bidder offering an article that meets the requirements of the United States, as stated in the specifications, is the one that must be accepted. The acceptance of a higher bid is not authorized unless it appears conclusively that the article offered by the low bidder is not in accordance with the specifications.

Permission for any change in a bid is a matter for most serious consideration. After all the bids have been opened and bidders have ascertained the amount quoted by other bidders there might arise a temptation to revise a bid either upward or downward as might best serve the interests of the particular bidder. This situation makes it necessary to adhere strictly to the well-established rule that in order to authorize a correction or withdrawal of a bid, on the basis of a mistake alleged after the opening, the evidence must be such as to show conclusively that a mistake was actually made. The numerous decisions of the accounting officers and the courts have been to the effect that in order to authorize a correction in a bid there must be presented immediately such convincing proof of the existence of an error as to leave no doubt. The showing required may consist of certified copies of estimate sheets or other convincing evidence of just how the error occurred and in what it consists.

Bidders are warned in paragraph 14 of the standard government instructions to bidders that negligence on the part of any bidder in the preparation of his bid confers no right to withdrawal after it has been opened. The matter of submitting bids for the advertised needs of the government is not one for such neglectful treatment by bidders as to give frequent cause for attempted withdrawals on account of alleged error. Bidders cannot be encouraged in submitting inadequately considered proposals in the belief that they may be withdrawn. If a bidder intrusts to an irresponsible employee such important matters as preparing estimates for bids on government contracts, he must bear the consequences of his trust. If the claim of error is not made until after acceptance, it must appear that the mistake was mutual or that the accepting officer knew or should have noticed the mistake because of the wide difference between it and other bids, and that he sought to take advantage of the error. After the contract has been awarded, the fact that a contractor elects to act on the instructions of the purchasing officer to make delivery and then presents a claim for the difference in price does not confer any right to the payment. In electing to follow such a procedure a contractor removes from consideration the question as to whether there might have been such a showing of mistake as would have authorized a withdrawal. After having been awarded the contract and having received the benefits of the business, in preference to other bidders who submitted properly prepared bids, the payment of any amount in addition to the bid price must be on the basis that the erroneous quotation was very much below the actual cost of performance. The court stated the proposition very clearly in the following quotation:

> The party alleging the mistake must show exactly in what it consists and the correction that should be made. The evidence must be such as to leave no

reasonable doubt***on these points. The mistake must be mutual and common to both parties to the instrument. It must appear that both have done what neither intended***20 Wall 488.

Typical withdrawal decisions

The question whether a bid may be withdrawn or corrected is one for consideration of the Comptroller General of the United States as head of the General Accounting Office. There are submitted to this office numerous cases in which the bidders claim error in the preparation of their bids. Those cases in which withdrawal or correction may not be permitted involve thousands of dollars in losses to business concerns annually. The facts in some of these cases may serve as a warning to bidders to be more careful in the preparation of bids on government requirements.

The following are a few of the cases which have come before the accounting officers recently. They have been selected as being representative of the errors most commonly made in the submission of bids for government business.

1. The bidder based his quotation on the estimates of another concern which he failed to check because of lack of time. It was held that if a bidder elects to employ some other concern to make up his estimates and accepts such estimates as his own, he must bear the consequences. It was said further that there was shown only an ill-advised bid not properly considered before being submitted.

2. The error alleged was in figuring the cost of trucking to site of work and using wrong wage scale in figuring the cost of labor. It was held that there were shown only errors in judgment on the part of the bidder from which there could be no relief after the bids were opened.

3. The error alleged was that the bidder failed to qualify his bid to the effect that he did not desire to accept the award of only one item out of three bid upon. The request for relief was made in the face of an agreement in the proposal that it was submitted with the understanding that unless otherwise specifically qualified a separate award might be made as to any single item. It was held that while it might be possible, as alleged by the bidder, that no profit would be realized in the construction of the water tank and not the buildings with which it was associated, this fact did not justify the conclusion that the bidder should be permitted to withdraw—the government having issued all warnings reasonably necessary.

4. The bidder assumed that the shipment would take the carload rate, whereas it was discovered later that less-than-carload rates would have to be paid. It was held that the bid submitted was the bid intended and that the error was simply a failure properly to estimate the weight of the shipment.

5. The apparent reason for requesting withdrawal was that the bidder, through negligence on his part or otherwise, was not properly informed as to the price at which it could obtain the articles proposed to be furnished to the government. It was held that this fact clearly would not entitle the bidder to relief from its undertaking.

6. The bidder claimed that its estimating department had left out certain items in connection with the installation, making its bid approximately $900 below what it should have been. It was held that there was a failure to show exactly in what the error consisted and the correction that should be made to leave no room for reasonable doubt with respect to the error.

7. The low bid was $85,000 lower than the next bid, but the bidder claimed only an error of $58,000. The evidence submitted in support of the claim of error consisted merely of two sets of summary sheets. One set was said to be the set on which the original quotation was based. The second set, made up after the bids were opened, was in the same form but with quantities and amounts of some of the elements increased. There was nothing in the tabulation to show which units of work were not considered in the original computation. It was held that the facts submitted were insufficient to warrant the conclusion that there was actually such a mistake as would authorize relieving the bidder of its obligation to perform in accordance with its bid.

8. There were submitted bids for the construction of a government building. The low bid was only $1,800 under the next bid, but the low bidder claimed an error of $53,000—it being stated that due to haste in preparing and computing its bid one of the subcontractors had inadvertently omitted an item of wood trim. It was held that the difference was not sufficient to make the error apparent upon the face of the bid, and that if the time allowed was too short for a proper preparing of its estimates the bidder should have refrained from bidding. Having submitted the bid, it was the bidder's obligation either to perform the contract in accordance therewith or pay to the United States the damages sustained through its failure to execute the contract and furnish the required performance bond—this damage to be the difference between the low and the next higher bids.

9. The bid was clearly stated as to unit prices, and the total was stated accordingly. An error was claimed in the unit price. The bid was accepted and the award made before there was any discovery or allegation of error. It was held that as there was nothing in the bid to indicate that a mistake had been made, payment in excess of the bid price was not authorized.

10. At the time of opening the bid there was some doubt in the mind of the contracting officer as it was much lower than other bids submitted. The matter was brought to the attention of the bidder, and the quotation was verified by him as correct. After the verification there was no other course for the contracting officer to follow but to make the award of the contract. It was later urged by the bidder that the quotation was made and verified by an irresponsible employee who had later been discharged. It was held that the bidder must bear the consequences of its error, as the government could not assume responsibility for inefficiency on the part of a bidder's employees.

11. The bid was clear and unambiguous on its face, and the mistake, if any, apparently was due solely to the bidder's negligence. Upon the bidder's refusal to make delivery, the supplies were purchased against the bidder's account at an increased cost of $142.80 over the bid price. It was held that the facts and circumstances were such that there was no authority to relieve the bidder from its obligation to pay the difference in cost to the United States.

12. A deposit of $8,000 was made on the express condition that in case of failure on the part of the bidder to enter into a contract and furnish bond the amount would be retained by the government as damages. The bidder returned the contract and bond unexecuted with advice that it was thought advisable not to perform the work. The difference between the low bid and the next higher bid was more than the $8,000 deposited as a guarantee. It was held that under the plain terms and conditions of the bidding the amount deposited became vested in the United States, and that there was no power or discretion vested in any administrative officer to waive such right by returning to the bidder the amount deposited.

The price of ignorance falls so heavily in some cases that there is aroused a feeling that government officers are unfair in their dealings. It must be remembered that public officials are guided by definitely established rules and can show no favoritism.

Denver Sets Fire Hydrants on Side Streets

It has been standard practice in Denver for a number of years to set fire hydrants on the northeast corner of an intersection on the side streets away from the main east-and-west traffic arteries. In a street-widening project now under way it became necessary to move the plugs back to the new curb line on the main street or to the standard location on the side streets. In spite of much additional expense, the board of commissioners decided to set them in the standard location because of the added factor of safety of the hydrants. About fifteen hydrants per year are broken by traffic, which is not a large percentage of the 4,470 in service.

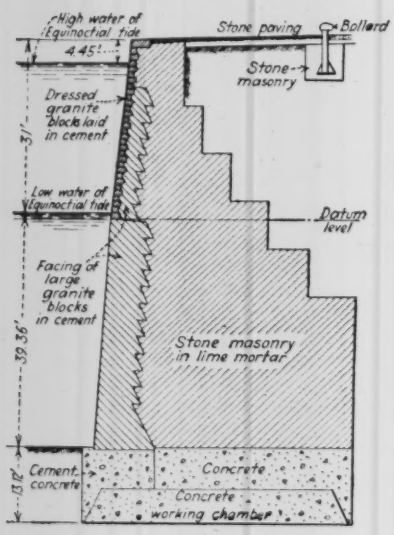
Heavy Engineering Works at the Port of Havre

Four types of modern quay construction at the French seaport include solid and hollow walls, arch spans and a trestle design with precast members—Seawall construction and large caisson work in harbor entrance

By E. E. R. Tratman
Wheaton, Ill.

EXTENSIONS of the Port of Havre as described in *Engineering News-Record*, May 24, 1934, p. 653, have been distinguished by a number of interesting marine structures and construction processes. Quay walls, deep-water caisson work and heavy seawall requirements inspired a variety of designs unusual in practice. In this article a number of the more striking designs are described. Their position in the port works may be identified by reference to the article referred to above.

FIG. 1—MASONRY QUAY WALL built on steel caissons and footed on concrete.



Quay walls

Quays providing nearly 8,000 ft. of berthing space for large passenger steamers form the north side of the new tidal basin at Havre, including those owned and operated by the Port Authority and the North Quay and Oblique Quay of a concession company. This great extent of quay is of particular interest because it includes four entirely different types of quay construction, with both solid and open front. Some of these were completed in 1933. Along the entire length there is a depth of about 40 ft. of water, and the construction is such as to permit of further deepening.

Solid Masonry Wall—The first stretch of wall built, known as the Joannes Couvert Quay, is 1,640 ft. long and consists of stone rubble masonry on a concrete base seated at 52½ ft. below low water (Fig. 1). The rubble masonry is faced with large granite blocks, and from a foot below low water to the top of the wall there is an additional facing of dressed granite blocks. At its base the wall is 46 ft. thick, diminishing to 8 ft. at the top, which is 5 ft. above the highest level of equinoctial tides.

This wall was built in steel caissons 141x46 ft. and 13 ft. 6 in. high, sunk by the pneumatic process. Adjacent caissons were 18 in. apart, and their opposing faces had vertical recesses 16½ ft. long and 4 ft. deep. With the space between a pair of caissons sealed by steel sheeting, the material was excavated and the space then filled with concrete, making the wall continuous and keying the blocks together.

Reinforced-Concrete Viaduct—For the next stretch, extending from the Joannes Couvert Quay to the east end of the basin (1,640 ft.), a more economical design was employed, consisting essentially of an arched viaduct to form the quay proper and sustain the shocks from vessels, while behind it is a retaining wall, built independently to hold the filled ground in the rear. As shown by Fig. 2, elliptical arches of 66-ft. clear span are carried on piers 15¾ ft. wide.

FIG. 3—CAISSON QUAY WALL of concrete carrying a deck slab and parapet wall.

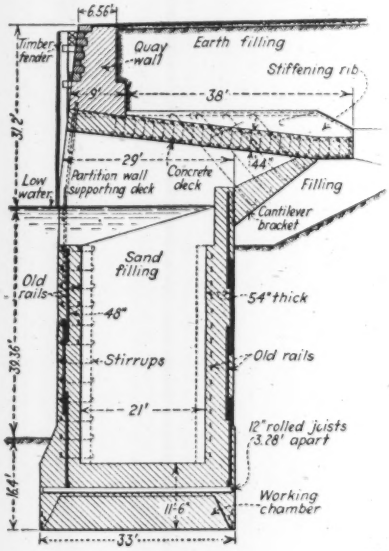
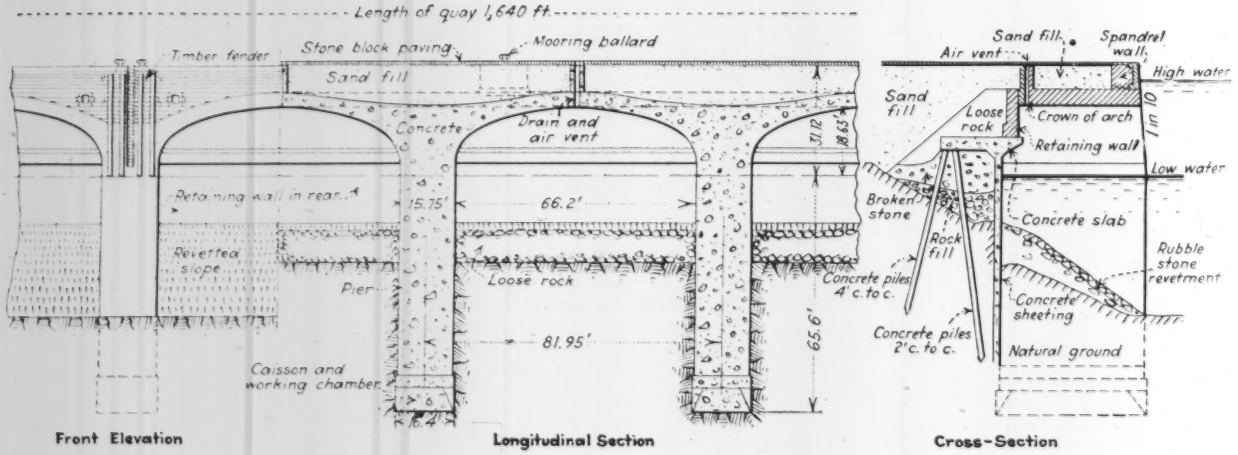


FIG. 2—ARCHED QUAY WALL of concrete with a parallel retaining wall to hold the earthfill.



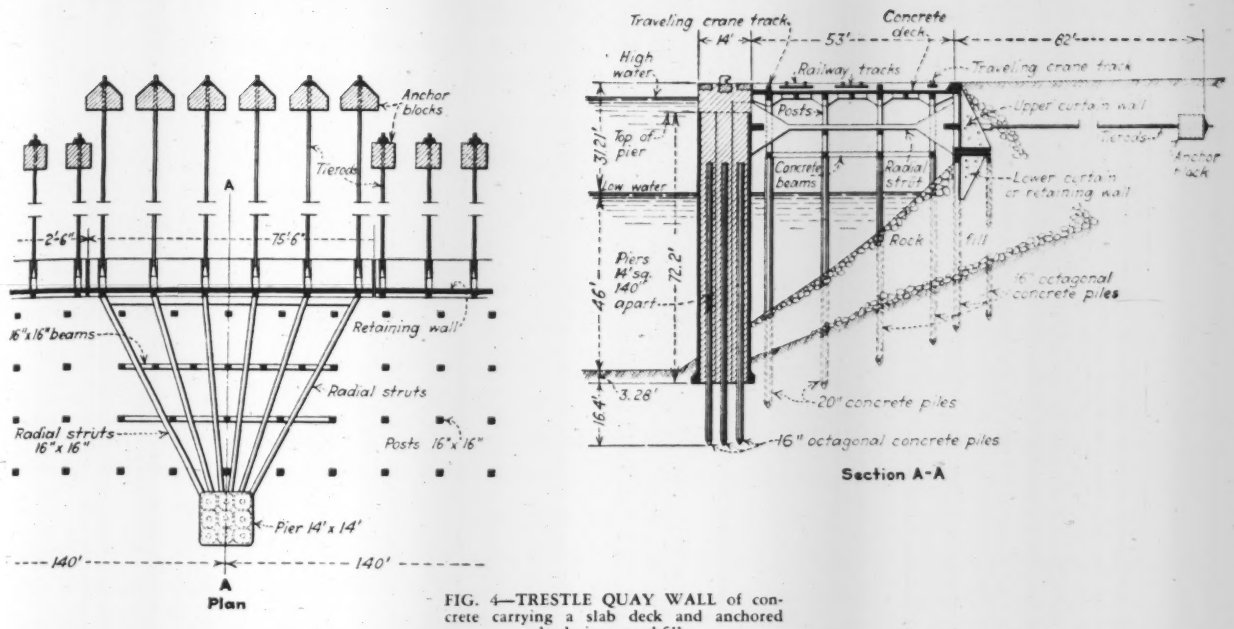


FIG. 4—TRESTLE QUAY WALL of concrete carrying a slab deck and anchored back into earthfill.

founded on caissons at 65.6 ft. below low water, or 96.75 ft. below the deck of the quay. Each pier is faced with a timber fender above the water line. Reinforcement of the arches includes old rails laid horizontally to reduce the thrust during construction. A concrete spandrel wall faced with stone, along the face of the quay, retains the sand filling.

The retaining wall at the rear of the quay is of concrete, 12 ft. high, without expansion joints but reinforced by lines of old rails. For part of its length it is supported on a concrete beam or slab 23 ft. wide, forming the cap on a line of concrete sheetpiling and having its shore side carried by two lines of concrete piles sloping in opposite directions, as shown. In the other part of the wall, difficulty in driving the sheetpiles led to the use of rectangular caissons about 68x11½ ft., which were sunk behind the quay, with their ends resting against the piers so as to close the openings. The caissons were sunk to about 52½ ft. below low water, and on them was built a retaining wall extending up to the level of the crowns of the arches. This construction was used at the terminal station (see Fig. 4 in the preceding article).

Reinforced-Concrete Caissons—For the next 575 ft., extending west from the solid-wall quay, a different design was adopted to avoid the high cost of a massive solid wall and the disadvantages experienced with long arch spans on independent piers for a structure built on unfavorable ground and subjected to severe blows from vessels. This stretch of quay was built in 1933.

Here the construction (Fig. 3) consists of hollow reinforced-concrete caissons, sunk in contact with each other and then filled with the dredged sand and gravel. The width of the caissons is 29⅓ ft., increased to 33 ft. at the base, as compared with 46 ft. for the solid wall. A concrete deck slab carried by partition walls of the caissons has its rear end seated on 13-ft. concrete cantilever brackets formed on the back walls, thus loading the caissons at the rear in such a way as to prevent any forward tilting. The deck slab carries the upper part of the quay wall and the earthfilling behind it. An opening 16½x19½ ft. in the front wall of each caisson relieves the hydrostatic pressure. Loose-rock revetment covers the filling within and in the rear of the caisson.

Concrete Trestle—A novel type of construction was designed specially for that portion of the quay built under concession from the Port Authority by the Compagnie Industrielle Maritime, including the North Quay, 1,968 ft., and a diagonal pier (the Oblique Quay) having a berthing length of 984 ft. on each side. In this design, owing to the great height and the necessity for rapid construction, the engineers of the company developed an economical design which distinctly separates the three main functions of a quay wall: (1) sustaining the pressure of the earthfill at the rear; (2) providing for the mooring of vessels; and (3) supporting the deck or floor of the quay, with its cranes and railway tracks. This design, shown in Fig. 4, is much less massive than those previously described, although it is considered equally substantial.

Shocks from ships coming alongside are taken by a row of concrete columns spaced about 140 ft. c. to c. and in water 46 ft. deep at low tide. These columns are 14 ft. square, and each consisted originally of a hollow bottomless shell or caisson 82 ft. high, weighing about 190 tons. These were built on shore and placed by the 200-ton floating crane, as shown by Fig. 5, the sinking being assisted by hydraulic jets. Each caisson incloses a group of nine square reinforced-concrete piles penetrating 16.4 ft. below the bottom. After being sunk, the caissons were filled with concrete, and the concrete was carried up above them to the level of the quay or deck.

These massive columns standing in deep water are braced against lateral shocks by a system of radial horizontal concrete struts, which spread in fan shape from each column and are seated against the retaining wall in the rear of the quay. The columns are so designed that each one can resist a direct shock of 500 tons normal to the line of the quay, 100 tons longitudinally, and a tension or mooring strain of 200 tons upon the bollard surmounting the column. It is stated that the columns could sustain, without damage to themselves, a force sufficient to damage the hull of a ship coming alongside at unreasonable speed.

A modification in the Oblique Quay is that the radial braces or struts are not supported intermediately, as in Fig. 4, but are of such section as to act as girders supported only at the ends. The head of this quay is protected by an independent triangular structure composed of three columns with longitudinal beams framed between them, so that the structure acts as a unit in resisting blows.

Behind the row of columns, but structurally independent, is the quay proper, having a reinforced-concrete deck slab 52 ft. wide and 2 ft. thick, with ribs or beams on the under side. On the slab is a 20-in. bed of sand that carries the stone-block paving. This slab is sup-

ported by a framework of precast concrete posts and beams carried by four rows of concrete piles of octagonal section. In the Oblique Quay, which is a pier and may receive shocks on both sides, a fifth row of batter piles is driven, and the horizontal fan-tail struts of the front columns are supplemented by diagonal struts in a vertical plane so as to constitute vertical trusses. By the use of precast concrete units for the deck framing and rear retaining wall, all made with quick-hardening cement, very rapid progress was made. Only the concrete for the deck slab and for filling the caissons was poured in place.

The filled ground in the rear of the quay is restrained only above low water. Below that level it slopes under the deck, its surface being protected by a heavy rock revetment. At the rear of the quay is a retaining wall built in two tiers. The upper tier forms a wall of the counterfort type, 20 ft. high, with its 10-ft. base seated on a similar but inverted wall, which in turn is supported by two rows of concrete piles. To the upper section of the wall are attached tierods leading back to heavy anchor blocks, as shown. Each rod is encased in concrete for protection. In the Oblique Quay only the upper portion of the retaining wall was built, and in its narrower part the anchor blocks were omitted, the tierods connecting the two walls. The walls are of precast units built on shore in lengths weighing about 100 tons each, which were set in place by a 200-ton floating-tower crane.

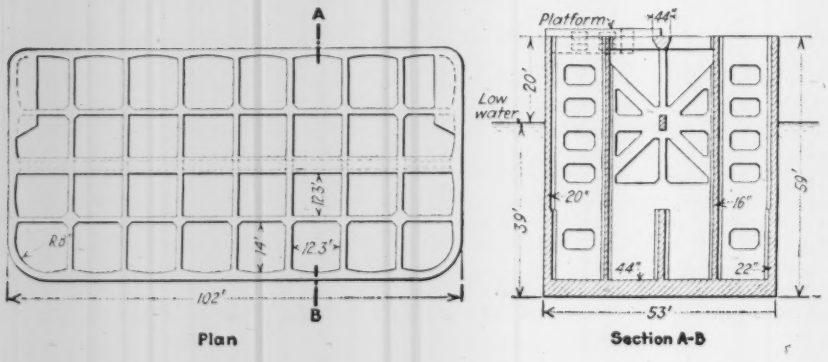
FIG. 5—FLOATING CRANE of 200-ton capacity, placing 14-ft. square concrete caissons alongside trestle quay wall.

Floating caisson work

Of special interest is the provision made for future widening of the outer harbor entrance to 1,000 ft. without heavy expense and difficulty in demolishing the heads of the new 820-ft. entrance, which is in deep water and on an exposed situation. For this purpose one of the heads of the entrance is composed of three huge hollow caissons of reinforced concrete (Fig. 6). They were built in the drydock and floated into position, where they were filled with sand and so sunk into a dredged foundation trench. When the outer breakwater is to be built, the sand will be removed from the two end caissons so that they can be floated away, leaving the third as the permanent end of the embankment. Those removed will be towed out to the breakwater site and sunk to flank both sides of its 2,000-ft. opening for the deep-water channel.

The first of these great caissons was sunk in July, 1931, landing on the natural soil in a trench dredged to 50 ft. below datum or low water. This caisson, which will remain permanently, is 101.68x52.48 ft. and 59 ft. deep; it floated with a draft of 44.28 ft. The three are said to be the largest concrete caissons ever floated and sunk.

FIG. 6—CAISSON for harbor entrance, designed to be refloated and removed when entrance is widened.



New embankment

A total length of 2.6 miles of sea embankment, inclosing the water area of the outer harbor and the tidal basin, consists mainly of a rubble mound capped with a base course of concrete blocks upon which is a concrete wall having a 1:3 slope with masonry facing on the outer side, and a stepped rear face with rockfill backing. The south embankment, however, has no backing. The new part of this embankment, mentioned above and shown in Fig. 7, is of very similar construction to the old one that it replaces. Its base consists of a bed of stone quarry blocks faced with concrete blocks, this rock work being deposited on the bed of the sea and leveled off. The material was obtained largely by the destruction of the old

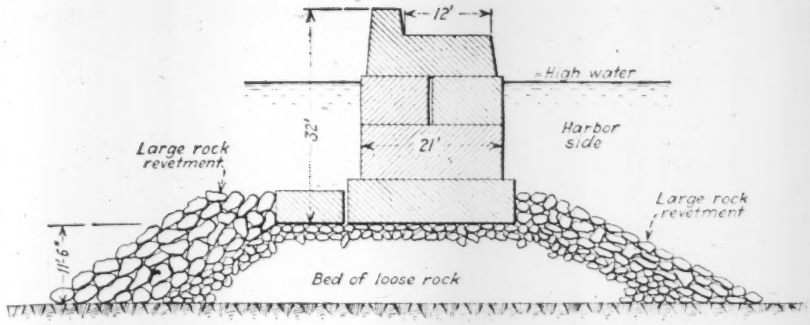


FIG. 7—NEW SEAWALL inclosing tidal basin and replacing old structure.

embankment. Upon this base is a seawall of 100-ton concrete blocks, set in place by a floating derrick of the sheer-leg type. The old wall was of stone masonry, built in place, but the new design is more economical.

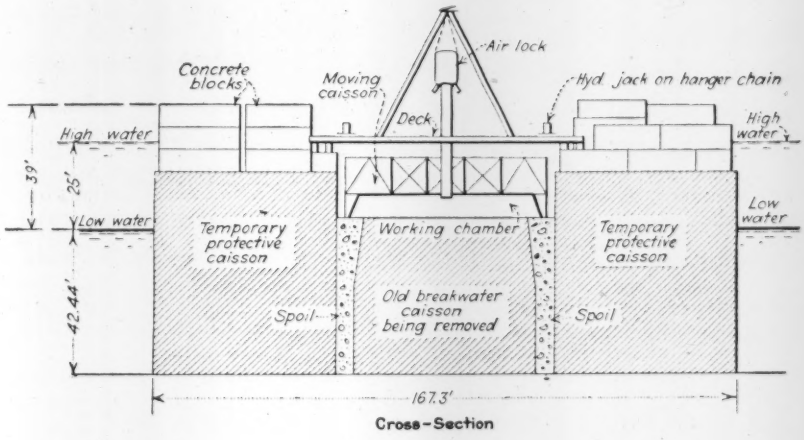
The first step was to remove the old head at the channel entrance. This had to be done in the open sea, exposed to rough weather and rapid currents. Moreover, the structure consisted of a metal caisson that had been sunk by the pneumatic process to El. 41 ft. and then filled with stone masonry.

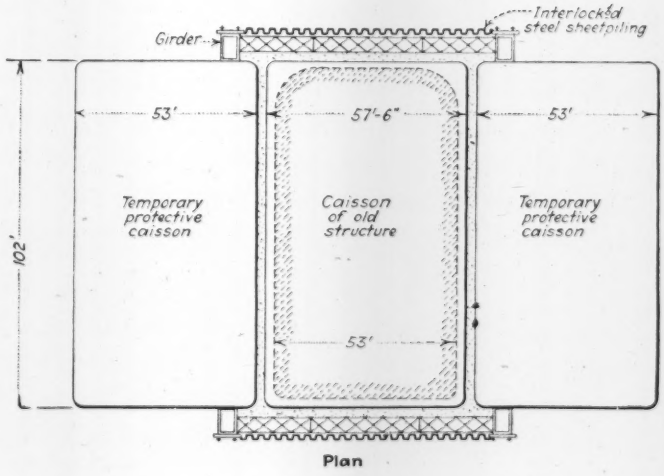
The plan adopted for its demolition, shown in Fig. 8, was to utilize two of the reinforced-concrete caissons mentioned above. These were sunk on opposite sides of the steel caisson and surmounted by 100-ton concrete blocks piled up to such a height as to form a working platform and protect the work from the highest waves. Between these concrete caissons and covering the short sides or ends of the embankment were rows of steel sheetpiling braced by trusses whose ends rested against the concrete caissons, thus forming a cofferdam. Supported by these caissons and spanning the old steel "head" caisson was a heavy steel-girder framing. After the upper part of the old work had been removed, a steel caisson with pneumatic working chamber was placed over the "head" caisson, being suspended from the girders by chains composed of long plate links attached to hydraulic jacks, the caisson being lowered as the demolition progressed.

In destroying the old embankment, the masonry wall is blasted, and its débris, with the old rock base, is removed by three special machines: (1) a gantry crane traveling along the embankment; (2) a 25-ton floating crane having a grab bucket of the orange-peel or four-section type, which can pick up 5-ton blocks under water, without the assistance of divers; (3) an American-built floating dipper dredge with 8-yd. bucket, 60-ft. dipper handle and 60-ft. boom, capable of dredging to a depth of 40 ft. This last machine excavates the rockbed foundation of the wall and can handle rocks weighing 10 tons or more. It has no propelling machinery but is set up on three spuds, and moves ahead by swinging to and fro around one spud, thus avoiding the encumbrances of mooring chains and anchorages.

When these outer works are completed and the breakwater is to be built, the first step will be to remove the two caissons from the opening in the embankment and to sink them on opposite sides of the deep-water channel at the breakwater site. This partial protection will facilitate the work of the dredges on the outer part of the channel and will create a protected roadstead that can be used by hydroplanes and by vessels which only touch at the port and wish to avoid the delay of going up to the docks.

FIG. 8—METHOD OF REMOVING old seawall, using floating caissons between temporary protection caissons sunk to the harbor bottom.





Accomplishments of CCC in Bridge Building

Bridges constructed by the Civilian Conservation Corps since the beginning of their work in April, 1933, total 21,907, with 2,678 now under construction, according to a report of the U. S. Forest Service. Of the completed structures, 10,453 were built under the direction of the Forest Service on roads and trails in the national forests, and 7,946 of this number provide for vehicular traffic. The other bridges have been constructed under the supervision of state agencies or other federal departments charged with directing the work of the CCC.

STABILIZED SOIL-BOUND ROAD SURFACES

III—Construction and Maintenance

Accepted practice in constructing and maintaining stabilized soil roads summarized in the light of tests and practical experience

By W. R. Collings and L. C. Stewart
Road Stabilization Department, The Dow Chemical Company, Midland, Mich.

THE PRINCIPLES and test results of soil stabilization given in the preceding two articles are the basis of a rapidly developing construction practice. This is reasonably simple but is far from a haphazard or rule-of-thumb procedure. In the following account of construction methods close touch has been kept with actual field practices interpreted in the light of theory and test results.

Preparatory procedure

Drainage is the first essential when a stabilized wearing course is to be constructed on a new grade. It is sometimes advisable also partly to stabilize the existing surface, so that the mixing equipment can be operated without breaking through.

Occasionally sandy grades may be stabilized sufficiently by spreading from 1 to 2 in. of clay on the road with little or no mixing. In some cases it is more economical to estimate accurately the quantity of clay that is to be used, and to prepare and mix it thoroughly with the sand. As a well-prepared base of this type will require less surfacing material, the saving will, in most cases, more than pay for the treatment. When the grade is largely clay, it can be used in dry weather as a base for the mixing operations, but if sand or stone screenings are available, at low cost, it will usually pay to stabilize clay grades, and thus to reduce the required depth of wearing course. If the surfacing is done during the spring or fall, such treatment will probably be necessary.

It is sometimes possible to secure materials directly from the gravel pit containing all of the constituents in the correct proportions. Occasionally it is convenient to add clay to the gravel at the pit. At the county pits in Huron County, Mich., clay is delivered during the fall to a depth of 5 or 6 ft. on the surface of the gravel. Weathering during the winter reduces the binder to a relatively friable condition. The proper proportion of this material is scraped into the hopper along with the gravel and passes through the screening plant, where it is quite thoroughly mixed with the coarser materials. The only difficulty occurs in wet weather, when sticky clay is apt to plug the screens.

Generally, mixing on the grade is more satisfactory. It is customary to deliver the aggregates first, windrowing this coarse material to make room for the delivery of the binder. The latter is then dried, pulverized and mixed with the coarse material as subsequently described.

The type and source of aggregate will control the kind of binder. If the aggregate is slag, stone chips or pebbles, with little or no sand or clay, a binder of natural sand clay, containing both coarse and fine sand, is desirable. Such a binder is comparatively easy to break up and mix with the aggregates. If such material is not available and a clay containing little or no sand must be used, then sand or other fine aggregate must be added to the mixture. If the material to be used for surfacing contains some soil fines but lacks sufficient cohesive material, then a binder consisting largely of clay and silt will be found necessary.

The quantity of binder that must be added is determined by the laboratory tests described in article I, May 24, 1934, p. 660. The finished mixture, according to the specifications of the Calcium Chloride Association:

> Shall consist of coarse aggregate, fine aggregate and natural soil binder, supplied individually or in combination, to give the following proportions:
>
> | Passing | Per Cent |
> |---|---|
> | 1-in. sieve* | 100 |
> | ½-in. sieve | 95 |
> | No. 4 sieve | 55- 85 |
> | No. 10 sieve | 40- 65 |
> | No. 40 sieve | 25- 50 |
> | No. 270 sieve† | 10- 25 |
>
> *Sieves for graduation analysis shall have square openings and shall be the U. S. Standard Series for No. 4 and finer.
> †Standard settling-rate test ordinarily used in the mechanical analysis eliminates the need of the No. 270.

The fraction passing the No. 270 sieve shall not be more than two-thirds of the fraction passing the No. 40 sieve. The

FIG. 1—CLAY BINDER secured by cutting down shallow bank and blading into a windrow for loading.

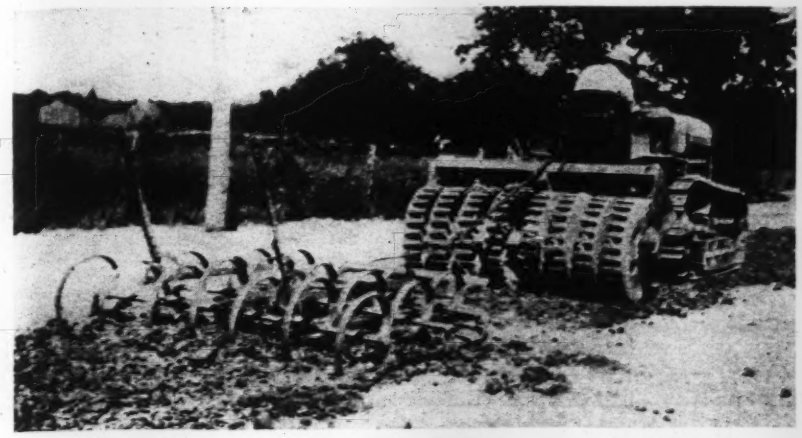


FIG. 2—PULVERIZING CLAY on road with special roller followed by spring-tooth harrow.

fraction passing the No. 40 sieve shall have a plasticity index between 6 and 14 as determined by the physical test methods of the U. S. Bureau of Public Roads. (Described in *Public Roads*, October 1931; also in shortened form in "Road Stabilization Testing Procedure." The Dow Chemical Company, 1933.)

The most desirable clays are highly cohesive, very sticky and difficult to load by hand. Normally, roadbuilders would plan to use power shovels. This material may be loosened for hand-loading by a plow, drawn by a truck or tractor, or by a grader drawn by a tractor, or by blasting. The most economical hand-loading system observed was in a long borrowpit, in which the clay was loosened with plows. About 40 men were stationed along the path of the trucks. A large number of 1½-cu-yd. trucks moved very slowly past the shovelers, so that each truck was loaded by the time it reached the end of the pit.

Pulverizing and mixing binder

Occasionally the clay may be pulverized in the pit. In one case, when the material was very dry, it was plowed and pulverized with a drag, then screened through a portable gravel screen having about ¼-in. openings. Usually, the clay is damp when taken from the pit and must be dried and pulverized on the grade. While some pulverizing may take place during the drying period, the degree of fineness that is required can be attained only after the moisture has been almost entirely removed.

Various devices are used for reducing the clay to a powder. Some engineers spread it down the center of the road and start to break it up while it is drying with a light roller and harrow, as illustrated in Fig. 2. A scraper truck with an air-operated blade is a good machine if the pressure on the blade is so adjusted that the small lumps of binder material may pass under it. Sometimes it is advantageous to attach

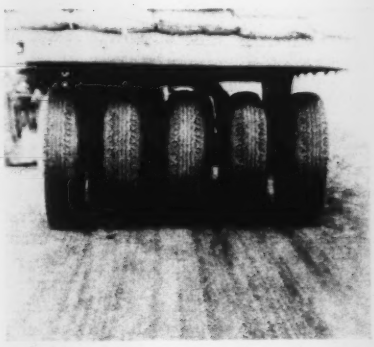


FIG. 3—TRUCK-TIRE ROLLER for compacting stabilized mixture after spreading.

a spring-tooth harrow or other type of drag to the scraper truck in such a position that it will break the larger lumps as they are delivered from the blade. The multi-blade maintainer is effective for manipulating the clay while it is drying, and for finally pulverizing it. The motor grader is used frequently for manipulating clay while it is drying and being pulverized with other equipment.

The work required to do a thorough mixing job is greatly increased if the materials become wet before mixing is completed. The quantity required to make a 3-in. wearing course is about the maximum that can be handled conveniently at one time. The mixing can be readily accomplished with a tractor-drawn or motor grader; a multi-blade mixer of the type sometimes used for preparing retreads is also suitable, and in most cases a spring-tooth harrow is effective in supplementing the work of the other devices. The mixing should be continued until the binder is thoroughly distributed.

Shaping and compacting

To consolidate the mixed materials satisfactorily, they should contain about 3 to 6 per cent by weight of moisture. If ready-mixed material is being applied directly from the gravel pit, it usually contains sufficient water to be compacted immediately; this is one of the outstanding advantages to be obtained from the use of gravel prepared at the pit. In some cases calcium chloride has been added at the pit to conserve the moisture until compaction. This requires at least 15 lb. of calcium chloride per cubic yard.

If the materials have been mixed on the road surface and are dry, they are dampened by a sprinkler wagon. The best procedure is described in the specifications of the Calcium Chloride Association, as follows:

> The mixture of binder and aggregate shall be bladed onto the shoulders of the road. The base shall be moistened uniformly, using a suitable sprinkler. Approximately one-fourth of the material from the windrows shall be bladed immediately onto the moistened base. The newly distributed road material shall be similarly moistened, and covered as before with one-fourth of the original windrowed gravel. These operations shall be repeated until the last layer of dry mixture has been placed.
>
> Before moistening this top-surface material, the road shall be shaped and compacted, using truck graders and traffic, or other trucks or rollers as directed by the engineeer. During the compaction operation, care must be exercised to maintain a smooth surface and a crown of between ½ and ¾ in. per foot. After shaping is completed, the surface shall be thoroughly dampened and again compacted.

If the materials in windrows become wet from rain, they may be bladed onto the road and shaped and compacted while drying. Usually when wetted by rain, excessive water will accumulate in the low sections of the road. Some time will be required before this material becomes dry enough to remain in shape or to resist rutting. The use of the spring-tooth harrow in such soft places will promote rapid drying and consequent hardening. Shaping and compaction of the road should be continued until the moisture has dried out to a point at which the wearing course becomes firm. A new type of roller, which will prove very satisfactory for use during the compacting operation, is shown in Fig. 3.

Both field experience and the tests described in article II, June 7, p. 738, show that cohesion is the greatest single controllable factor in the development of resistance to water entrance and resultant pitting of stabilized wearing courses. The finished mixture should then contain sufficient cohesive material to raise the plasticity index into the upper part of the specified range, namely, 10 to 12 per cent. While a newly-made surface having these properties may become slightly slippery when it is wet, this condition can and should be eliminated by a light surface cover; between 25 and 50 cu.yd. per mile of pea gravel or fine stone chips are ample.

The calcium chloride is generally applied on the finished damp surface, but some engineers prefer to incorporate it into the wearing-course materials when the mixture is being prepared. This helps to retain moisture in the mixture; its disadvantage is the large quantity required, usually 5 or more tons per mile. At present it is considered more economical to treat the finished surface at the rate of about 3 tons per mile, 16 ft. wide, or about 0.6 lb. per sq.yd. This quantity will hold the moisture effectively in stable surfaces and can be followed by applications of one or two tons per mile as may be required.

Reconditioning old roads

The stabilization of wearing surfaces on existing roads may require the treatment of loose surface material; of new resurfacing aggregates, or of either or both of these combined with scarified road metal. A careful inspection should be made to ascertain the depth to the wearing course at a number of stations and samples for tests in the laboratory should be taken, generally at one or more stations in each mile. On projects several miles in length, consisting of a uniform grade of material, samples taken from two or three stations will be enough usually for the entire project. The samples of gravel are combined with the selected binder soils, and the tests should meet the requirements given in the specifications for the finished mixture. The quantity of clay, as calculated from the laboratory tests, is usually stated in terms of cubic yards per 100 lin.-ft. of road. The procedure to be followed in carrying out the subsequent operations varies widely, depending on the condition of the original road.

When the road is smooth and firm, but carries a loose cover on a relatively stable base, the loose material can be stabilized and bound to the surface easily by the addition of soil binder. A natural clay containing an appreciable proportion of sand will sometimes be found desirable, as frequently fine aggregate is lacking in the loose material on road surfaces. If the loose material is bladed to the center and the size of the windrows is accurately measured at a number of stations, the quantity that is to be treated can be determined. Then the amount of binder that is needed can be computed from the usual laboratory tests.

The clay may be delivered on top of the loose material, either on the shoulders or in the center of the road. It should be dried, pulverized and thoroughly mixed with the loose material in the usual way. If the quantity of mixture is not too large to handle easily when wet, it may be left on the shoulders until after the first rain, when it can be returned to the road surface. It is always preferable, however, to place and consolidate the mixture with the water as soon as possible. This treatment should be followed immediately with the calcium-chloride application.

FIG. 4—A STABILIZED ROAD in Michigan, showing smooth and firm surface obtained by this method of construction.

The procedure outlined for construction of stabilized wearing courses fully covers the methods to be followed when resurfacing with new material; this is preferred where the existing course is less than 2 in. thick or where it contains a large quantity of oversize stones. Stabilizing existing wearing-course material is employed if the road carries a sufficient depth of material; but if the soil fines are not stable, samples of the road material and of the available binder should be tested, and the proper proportions of each should be determined in the usual way. If the surface is wavy and rough, it should be scarified and reshaped, and any oversize stones that are present should be removed before stabilization is begun. The clay is then delivered, dried and pulverized, and the dried binder is spread uniformly over the road surface. The latter is scarified through the layer of fine cohesive material to the desired depth, and the wearing course is then mixed by blading as already described.

Maintenance of stabilized wearing courses

The stabilized wearing course makes possible a substantial saving in the cost of maintenance, as compared with ordinary gravel or stone roads. This does not mean, however, that a road of this type may be built and forgotten. Some of the experience that has been obtained to date, largely on Michigan roads, will be described.

The first essential for a satisfactory riding surface is a smooth and adequate crown. The crown desired will vary in different localities, but the need for frequent blading will be reduced by a crown in excess of ½ in. per foot.

Stabilized wearing courses become extremely hard in dry weather; water penetrates only a fraction of an inch into the surface, so that if scraping is necessary, it must be started while the road is still wet and must be completed while it is still damp, and frequently this period is very short. These roads dry quickly in summer. The same resistance to water entrance reduces pitting and makes it unnecessary to blade following every rain.

If stabilized roads become pitted due to prolonged dry spells, patching is necessary. The preferable aggregate is under ½ in. in size, mixed with at least an equal weight of stable sand-clay. To insure that the patching materials will be moist enough to stick securely in the hole, the admixture of 100 to 150 lb. of calcium chloride per cu.yd. is recommended. One county engineer has set aside a concrete mixer at the county garage for the purpose of dry-mixing stone chips, sand, clay and calcium chloride for patching purposes. Others prefer to mix the materials when building a stock pile or to load them in layers in the correct proportions in the patching trucks, depending on the subsequent handling to finish the mixing.

In localities where water may be obtained easily and sprinkling equipment is available, satisfactory reshaping can be accomplished by sprinkling. The sprinkling should be followed within a few minutes by the motor grader. This method can be used to the best advantage in the early morning, when little or no loss of water will occur. While this may seem at first to be a rather costly type of maintenance, it will be found that it is often more satisfactory and less costly than extensive patching operations.

Any need for sprinkling before blading or for extensive patching during dry weather can be minimized or eliminated if close attention is given to the continuous maintenance of a moist road surface by the use of a number of light applications of calcium chloride during the season. The most effective results and the highest efficiency will be realized if care is taken to make the applications when the road still contains moisture following a rainy period. It is only

under such conditions that the light treatments recommended—namely, 1 to 2 tons per mile—are sufficiently effective to warrant their use.

The prolonged wet periods that take place in fall and spring result in the loss of some of the fine materials from the surface of roads If a tightly bound surface, free of loose cover, is to be maintained throughout the summer, such loss of material will have to be replaced in the spring, each year or two. This requires a very light treatment of binder material, as outlined under procedure for smooth, relatively stable roads with loose material on the surface.

The quantity of binder required and the frequency of the treatments depend to a large extent on the amount of traffic which the road carries. The amount needed will range, however, between 20 and 50 cu.yd. per mile, depending upon the quantity of loose material and the quality of binder that is available. The soil binder must be pulverized and mixed with the loose material in the usual way. The stabilized surfacing mixture that results must be consolidated in a damp condition before it is ready for treatment with calcium chloride.

The fourth and concluding article in this series will summarize costs in actual practice of constructing and maintaining stabilized soil roads. It will be published next week.

Concrete Shell Roof Used on World's Fair Building

Modern dairy barn at Chicago Century of Progress employs Zeiss-Dywidag system of construction

ONE of the first examples in this country of the Zeiss-Dywidag system of roof construction (*ENR*, April 14, 1932, p. 537) is the stable portion of the exhibition building being built at the Chicago World's Fair by the Brook Hill Farm, of Genesee Depot, Wis., in cooperation with Starline, Inc., of Harvard, Ill. The building will house milk cows. Shell roofs of this type were developed to permit economic use of concrete in roofing buildings of large areas. The shell is subjected only to direct tensile and compressive stresses, and thus may be made self-supporting, eliminating the use of rafters, purlins and trusses.

The outside dimensions of the barn are 36x72 ft. Light-weight concrete masonry walls support the roof, which consists of five standard barrels, each 14x34 ft. The stiffening diaphragms in the end gables and the beams at the outer edges of the end barrels bring the eaves of the roof flush with the outside of the 12-in.-thick hollow walls.

Forms

In constructing the roof, steel forms were used for the gable diaphragms and the outer-edge beams. Steel channel ribs supported the barrel forms. The arched steel ribs were tied against spreading by tension rods made adjustable by turnbuckles. The ribs were spaced 3½ ft. apart, and were supported by curved steel beams running lengthwise of the barrels. The curved beams were required because the roof was given a double curvature to increase the clearance over the center aisle through the barn. The double curvature is not essential to the action of the roof, and this job, it is believed, represents the first application of double curvature to a barrel shell roof.

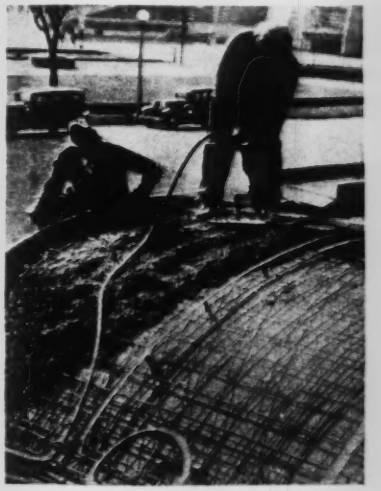
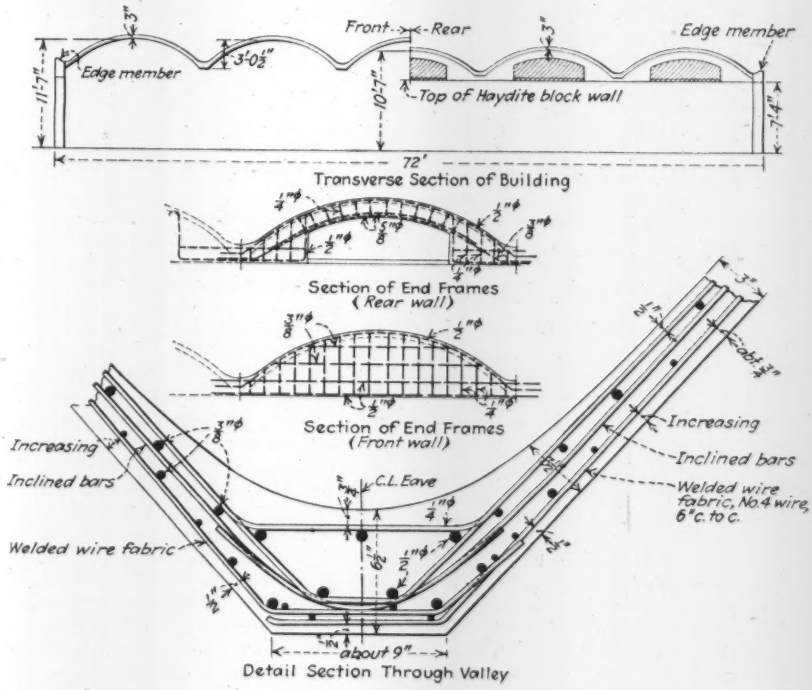


FIG. 2—CONCRETING the shell roof with the use of vibrators. Note diagonal reinforcing near end of barrel supplementing the mesh used elsewhere.

FIG. 1—TYPICAL DETAILS of shell roof on new building at Chicago World's Fair.



The main longitudinal and transverse reinforcement was a wire mesh made of No. 4 wire on 6-in. centers, or slightly less than 0.25 per cent. At the ends of

Reinforcing

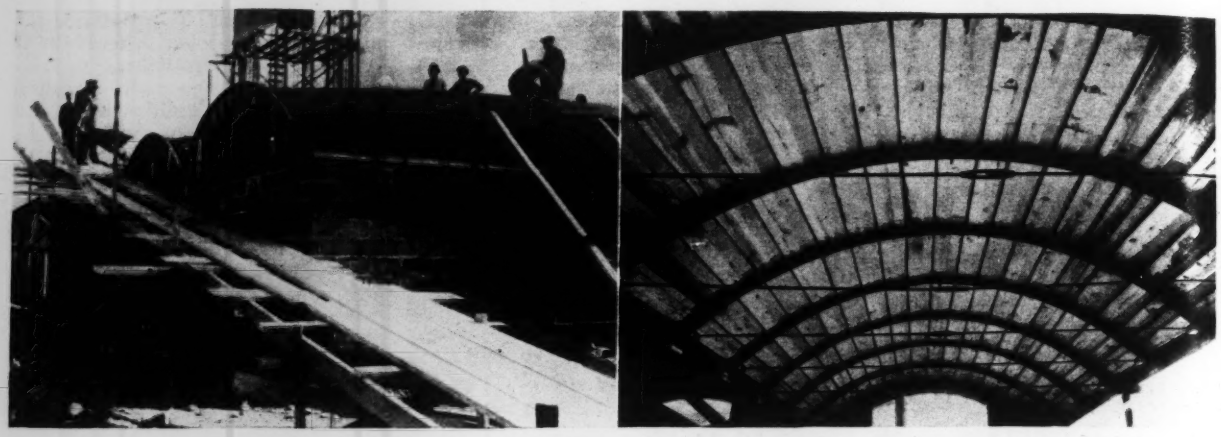


FIG. 3—CONCRETE SHELL ROOF under construction. In left view steel-gable forms and double curvature of roof barrels are shown. Right view shows steel ribs supporting sheathing and plywood form panels.

the barrels and covering about one-quarter of the surface area, additional ¼-in. round bars were placed in a diagonal position to resist the stresses occurring in those regions (Fig. 2). The edge beams and those parts of the shells forming valleys between adjacent barrels were reinforced with ⅜- and ½-in. round bars, to resist the tension developed in that area. By distributing the reinforcement throughout the whole tension zone, extending a short distance up the sides of the barrels (Fig. 1) no trouble was experienced in working the concrete around the steel. Furthermore, the steel was distributed in accordance with the intensity of the tensile stress, thereby avoiding a sudden transition at any section.

Concrete

The thickness of the barrels was 3 in. at the crown and only slightly more at the springings. The 3-in. thickness was in excess of that required for the load and span, but was provided to give the roof added insulating value. Haydite concrete was used to enhance the insulating value of the roof. Ordinarily cork board or other insulating material will be used on the under side of the barrels, but it was deemed unnecessary in this case because the building is to be used only during the summer months.

An all-Haydite concrete mix of 1:2½:2½ was used, with 6 gal. of mixing water. The resulting no-slump concrete was spread out with shovels, screeded and vibrated in place. The vibrators consisted of air hammers mounted on a steel plate to which 3-in.-long lugs were welded. These lugs penetrated the concrete and stopped against the form. In this way not only the upper surface was vibrated, but the under surface as well. A smooth top and bottom surface was thus obtained. Final finishing of the top was done by cement finishers with wood floats and steel trowels.

One day after placing the concrete the roof was given a paint coat of a special waterproofing material, which also served the purpose of sealing the mixing water in the concrete, insuring satisfactory curing.

Roberts and Schaefer Co., engineers of Chicago, in cooperation with Starline, Inc., of Harvard, Ill., designed the barn section of this exhibit. Richard Philipp, Milwaukee, Wis., was the architect. The Brook Hill Farm building was erected by the Continental Construction Co., Chicago.

Variations in Size of Building Brick

MEASUREMENTS of 660 samples of building brick from manufacturers all over the country showed that only 210 complied with the three-dimension standard specification for building brick of the American Society for Testing Materials. This survey was made by J. W. McBurney, Bureau of Standards, to determine the variation in size and weight of building brick to supplement a study on strength, water absorption and weathering resistance also made by Mr. McBurney, and published in the 1933 A.S.T.M. *Proceedings*, which described in detail the method of sampling.

The dimensions of the individual brick were measured to the nearest 0.05 in. using a steel scale, and the measurement represents the maximum in all cases. Oven-dried brick were weighed to the nearest 5 gr.

The difference in the size of one brick as compared with another results from two causes that act either together or separately. The bricks may have been formed to different dimensions, or there may be variations in the amount of shrinkage resulting from drying and burning. The effect of variation in degree of burning on size of brick is well known to brick manufacturers. Further, the bricks produced in some districts are quite uniformly different from the sizes and shapes characterizing bricks produced in other districts. For example, the brick produced in New England and the Hudson Valley are relatively smaller in breadth than those from most other districts, while the samples from California and Detroit, Mich., have a greater depth than those produced elsewhere.

The present specification of the A.S.T.M. for building brick provides the following dimensions as standard: length, 8 in. plus or minus 0.25 in.; breadth, 3.75 in. plus or minus 0.125 in.; and depth, 2.25 in. plus or minus 0.0625 in.

Out of the total of 660 samples (both hard and salmon) 489 fell within the tolerance allowed for length, 329 came within the specification for breadth and 461 for depth. Only 210 samples complied with the standard specifications for all three dimensions. Considering only the 525 hard samples, the corresponding numbers for samples within allowable limits were: 419 for length, 268 for breadth, 383 for depth, and 188 were within the specifications for all three dimensions. The results indicate that standardization of size for building brick is not particularly effective for the United States as a whole.

Conclusions—From the data obtained, the following conclusions are considered justified:

1. The "average" brick produced in the United States has the following size and weight: length 8.04 in., breadth 3.66 in., depth 2.27 in., volume 66.80 cu.in., and weight 4.54 lb.

2. Some producing districts of the United States characteristically manufacture non-standard sizes.

3. Where raw clay or shale is formed to a particular size, the degree of variation in size of the burned brick may be very considerable, depending upon the nature of the clay or shale and upon drying and burning practice.

New Pier Constructed Under Tilted Bridge Tower

Rio Grande suspension bridge at Hidalgo, Tex., damaged in 1933 floods, repaired by retrieving tower from a precarious position

By J. W. Beretta
Consulting Engineer, San Antonio, Tex.

A REPAIR JOB of unusual kind was completed last winter on the 450-ft.-span suspension bridge over the Rio Grande between Hidalgo, Texas, and Reynosa, Mexico. The work consisted of returning one of the towers to upright position (after the failure of its pier in a flood had caused it to tip as much as 20 deg. from the vertical) and transferring it to a new foundation. The bridge, a private toll structure originally designed and built in 1926 by contractors without independent engineering help, is shown in Fig. 1 shortly after the accident.

FIG. 1—FLOOD DAMAGE to a Rio Grande suspension bridge. View shows how the span was shifted and twisted by settlement and tilting of the tower pier.

The floods occurred in September, 1933, and the damages to the bridge were not at first apparent, being confined to the pier foundations supporting the American tower. However, where the American pier formerly had been some distance from the stream, after the floods it was in flowing water. Then at about 1 p.m., on Nov. 3, 1933, the foundations supporting the American tower pier failed suddenly and without warning, causing a tipping of the pier and tower downstream, a slippage of the pier base toward midstream and a general settlement of the pier and tower structure. The slippage of the two pier columns was unequal, which caused a torsional twisting of the concrete beam connecting the columns. Fortunately, there were no vehicles on the bridge at the time of failure, and a single pedestrian, near the Mexican tower, was unharmed.

In its new position the tower and pier were about 22 deg. out of plumb, leaning downstream, and about 10 deg. out of plumb, leaning toward the American bank of the river. It is believed that only the guying effect of the suspension cables prevented the tower and pier from turning all the way over on their downstream side. The movement of the top of the tower displaced the cables in a downstream direction, thus causing a corresponding torsion and displacement of the roadway and bridge structure proper.

The several contributing causes of the failure were easily and quickly established by examination. The pier proper was deficient in number of supporting timber piles, and the piling that was left in place did not have sufficient penetration to withstand the loss of friction and lateral resistance caused by scouring. In addition, the pile caps supporting the two pier columns were not tied together, which was detrimental to the lateral strength of the pier structure.

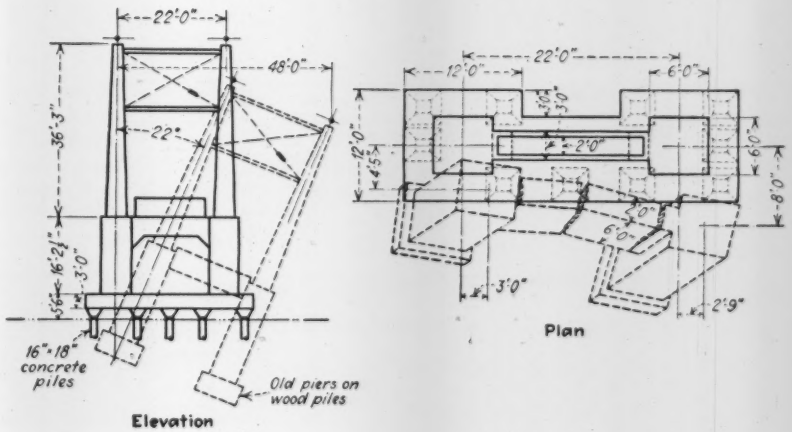
During the floods of a year earlier a rockfill was placed in the American approach in an attempt to deflect the river away from the cable anchorages. This rockfill displaced a considerable amount of silt and exerted outward pressure against the pier bases and piling. The 1933 floods scoured away this silt and removed the last vestige of lateral resistance from the pier and piling, with the result that failure was inevitable though unforeseen.

The Hidalgo-Reynosa Bridge is one of the most important crossings on the Rio Grande, connecting Texas state highway No. 66 and the new Mexican federal highway being built between the lower Rio Grande Valley and the city of Monterrey. The nearest means of communication into Mexico upstream is between Roma, Texas, and San Pedro, Mexico, a distance of 52 miles, and downstream is the bridge connecting Mercedes, Texas, with Rio Rico, Mexico, a distance of 30 miles. As there is no good completed system of interconnecting highways in Mexico, it was imperative that the reconstruction of the bridge be completed without delay.

Due to the peculiar type of failure, it was almost impossible to complete any very definite plans for reconstruction before the work was undertaken. Accordingly, after a conference with a number of contractors, it was ascertained that the work could best be handled by the owners of the bridge, utilizing day labor, leasing all necessary equipment and purchasing the necessary material. The uncertainty and hazard of the work made this decision almost mandatory. The writer's organization was commissioned to handle the work, which was largely a matter of field organization. The only office work done, aside from the pier design, was a calculation of the loads to be handled in the field.

The major piece of erection equipment was a steel stiff-leg derrick with a 110-ft. boom, which was erected to handle a maximum lift of 15 tons at a reach of 80 ft. Along with this derrick were collected a large number of heavy jacks of all types, railroad ties, heavy oil-well timbers, a single-acting steam pilehammer, paving breakers and miscellaneous tools. Rush orders were placed for steel needlebeams, two car-

FIG. 2—RELATIVE POSITIONS of new and old piers and of tower when tilted and upright.



loads of untreated yellow pine timber piling, reinforcing steel, cement, sand, gravel, form lumber and other material. Actual reconstruction was started Nov. 13, 1933.

The erection procedure first decided upon was found to be the best and was carried through until the completion of the project. In order to obviate the necessity of any underwater construction work in caissons, the new pier was designed to rest on precast concrete piles 50 ft. long driven to an average penetration of 46 ft. The position and inclination of the old pier and tower allowed the driving of all necessary piles without interference. Corbel construction was used between piling and base slab, providing additional resistance to lateral forces. In general, the preliminary work consisted of driving temporary piling, constructing supporting timber cribbing, inserting needlebeams and cutting away certain portions of the old pier that interfered with the erection.

Before moving the tower, great care was taken to see that it was braced, blocked and lashed, so that both tower legs could be handled as a unit. After insertion of needlebeams which were bolted to the tower legs, the tower was moved to its new position by the use of jacks, steamboat ratchets and turnbuckles. Jacking pressures corresponded to almost twice the dead load to be lifted, probably as a result of the inherent stiffness of the floor system. When the tower was about in position, but still below grade, the cribbing was rearranged to allow pouring of the pile cap and corbels on top of the new concrete piles. These piles and the pier cap were made with high-early-strength cement, permitting driving to begin within five days of the pouring of the first pile and jacking operations on the pier cap to start within 48 hours after pouring. Also, in order to enable final fine adjustment, plumbing and shimming of the towers, the top 2 ft. of the pier legs were made of high-early-strength cement concrete, although ordinary portland cement concrete was utilized for the remainder. This upper part was placed in a continuous pour, so that there is no construction joint between the two types of concrete.

On completion of the pier work, the tower was placed in its correct position and anchorbolts were connected. At the end of 21 days the cribbing was removed and the needlebeams burned off flush with the new concrete pier, leaving a portion of them permanently embedded. The remaining portions of the old pier were then pulled away from the new pier and turned over into the riverbed, so that they were not visible.

FIG. 3—RAISING THE TOWER to an upright position, using jacks under needlebeams to assist the pull of the derrick lines on the top of the tower leg.

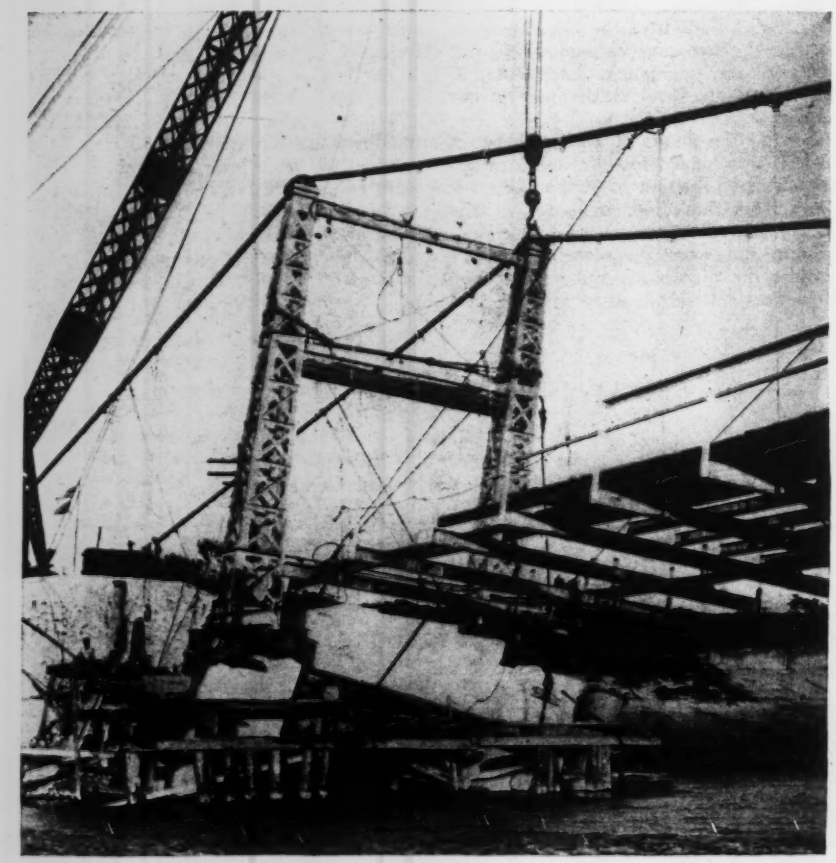


FIG. 4—WORK COMPLETED, showing operation of transferring load from needlebeams and blocking to new pier.

It was possible to reopen the bridge for limited traffic, proceeding at low speed, as early as Dec. 20, and from that date until the completion of the work traffic was delayed only intermittently. The hazard of the work was further increased by several days of bad weather accompanied by high wind, which caused some anxious moments when the towers began to sway and the cribbing to settle. However, a close watch was maintained at all times, and consequently no harm resulted.

It is interesting to note that the Hidalgo-Reynosa Bridge is of the unstiffened suspension type. Had it included stiffening trusses, the damage would undoubtedly have been considerably more extensive. As it was, no difficult operations were required to pull the bridge back into its former position. Among other fortunate circumstances, no appreciable damage to cables resulted. The damages to the structure proper were only superficial and consisted of the parting of a few bottom diagonal braces in the roadway. All bent pieces of steelwork were straightened and rebraced in the field. The writer is convinced that the unstiffened type of suspension bridge for light highway loads has many merits.

The job was completed Feb. 28, 1934. The total cost of the work was about $16,000, including all labor, materials, equipment, insurance and engineering.

The work was carried on by the J. W. Beretta Engineers, Inc., San Antonio, Texas, for the Valley Bridge Co., Hidalgo, Texas, of which J. E. Pate is general manager. The superintendent of erection was D. R. Parsons. The resident engineer and supervisor, representing the engineers, was H. F. Stubbs, to whom is due great credit for the development of erection methods and the satisfactory handling of a difficult project.

Dysentery Epidemic Detailed Before Waterworks Body

New supplies, water purification, distribution systems and waterworks administration also given discussion at annual convention of American Water Works Association

Engineering News-Record Staff Report

A DETAILED technical discussion of the epidemic of amebic dysentery which centered in Chicago last summer and fall, in regard to both epidemiology and the physical conditions that were correlated with the outbreak, featured the 54th annual convention of the American Water Works Association, meeting in New York City on June 4-8. Also of great interest at the convention were the papers that outlined the special problems involved in New York City's water-supply system, such as the control of underground leakage from water pipes laid in rockfill streets and the corrosive qualities of New York's mountain water supply. A number of other papers were presented at the meeting, devoted to the advanced and technical phases of water distribution and purification and waterworks administration.

The engineering features of the Chicago amebic dysentery outbreak were given complete discussion by Joel I. Connolly, chief, bureau of public health engineering, board of health, Chicago, Ill. Mr. Connolly in his paper first pointed out that heretofore outbreaks of this disease have been traditionally attributed to carriers, with the spread through the consumption of contaminated food. A study of the situation in Chicago, however, revealed a number of structural defects in the plumbing systems of the two hotels determined to be the foci of infection.

A description of the general plumbing system of the two buildings is first in order. The two hotels are designated as Hotels X and Z. Hotel X receives water from the Chicago city distribution system and, in addition to distributing it throughout its own establishment, also supplies water to the upper part of Hotel Z, to a theater close by and to several other small establishments.

The first health hazard presented by the plumbing system involved a refrigerating machine in the basement of Hotel X. The incoming city water was first led through the cooling coils of the refrigerator condenser. The cooling water then discharged into an open tank, from which it was pumped to an overhead tank that supplied the building directly. In parallel with this line of supply there was a second line by means of which city water was pumped directly to the overhead tank without going through the condenser discharge tank. Examination of this layout revealed two cross-connections between the pipes carrying the condenser discharge and a house sewer that was hung from the basement ceiling at an elevation above that of the water line. The purpose of the cross-connection was to permit the condenser to discharge into the sewer directly in case the tank should have to be taken out of service. However, the arrangement also made possible the passage of sewage into the water system in case the valve on the cross-connection should leak.

Another important hazard revealed was in connection with the circulating ice-water system in Hotel X. There was a tank in the basement into which city water entered, and which contained a cooling coil. This water was then piped to taps on the upper floors in maids' lockers. Directly above the basement tank there was a 6-in. sewer suspended from the basement ceiling. The tank was partly covered with insulating material, but the covering was in poor condition and at several points on the top exposed the water surface. The overhead sewer was not tight and at several points leaked on to the top of the ice-water tank.

There were a number of other health hazards discovered in the plumbing systems of the two hotels, in one of which the system was particularly complex.

A thorough discussion of the epidemiology of the outbreak was given by Arthur E. Gorman, engineer of filtration, bureau of engineering, Chicago. Mr. Gorman explained how, when the outbreak had focused attention upon the two hotels involved, all of the guests who had stopped at these two hotels during the summer were circularized. Data from Chicago cases were also solicited. The data obtained are still being studied, and the information presented by Mr. Gorman was as of May 15. Up to that date there had been discovered a total of 850 cases of amebic dysentery and 52 deaths. It was interesting to note that two-thirds of the cases discovered appeared out of Chicago.

During the period of investigation there were a total of 250,000 guest-days in the two hotels, representing 83,000 guests, 53,000 of whom had stopped at Hotel X and 30,000 at Hotel Z. From these 83,000 guests circularized, data were obtained from about two-thirds, revealing 466 cases and 32 deaths.

The occurrence of several heavy rainstorms in Chicago appear to be correlated with the incidence of the ailment. These rains were of such intensity that it is considered likely that the hotel plumbing was surcharged, intensifying leakage and making operative those types of cross-connection in which the water line was at a lower level than the sewer. Specifically, the data showed that the times of these storms were also the days on which a great number of guests were registered who subsequently reported an attack of dysentery.

Another feature of interest in the outbreak was that it was entirely free from the presence of typhoid. This was explained by the fact that the residual chlorine in the city water was able to disinfect any typhoid or ordinary dysentery bacteria, but was no protectoin against the encysted form of the organism responsible for amebic dysentery.

The presentation of these features of the epidemic was discussed at some length by Abel Wolman, chief engineer of the Maryland Department of Health. Mr. Wolman had been a member of the board of review which studied the outbreak in Chicago last winter. He emphasized in his discussion that the magnitude of the hotel population involved during the period of the hazard really made of the institutions two great vertical cities. Cities having populations in the neighborhood of 85,000 are ordinarily given great attention from the standpoint of public health, while institutions like hotels are not prone to consider that they have a great responsibility for guarding the lives and health of their patrons.

He also stated that he was surprised to find a complete lack of appreciation among intelligent laymen that cross-connections to potable water supplies constituted a hazard or even that the installation of such cross-connections was in conflict with building regulations.

New York's water problems

For a number of years the New York Department of Water Supply has paid a great deal of attention to underground leakage of water mains laid in rockfill streets, where such leakage is not likely to become evident at the surface (see *ENR*, May 31, 1934, p. 684). Recently the program of locating and repairing such leaks has been greatly intensified, both as a water-conservation measure and to create employment. The outstanding factors in such underground water-waste surveys were described by

Fred B. Nelson, of the Department of Water Supply, New York, N. Y. In Mr. Nelson's paper there was presented a classification into several types of the number of leaks found. Leaks discovered on live surfaces and in joints on the main line were responsible for 81 per cent of the total number.

Although most of the attention in the water-waste surveys has been given to pipe lines laid in rockfill streets, there were in addition several areas in downtown New York which were scrutinized and in which the subsoil conditions were quite different. In one such downtown area, which is characterized by congested subsurface conditions, large distribution mains and a sandy soil, a surprising number of such leaks was discovered, although no evidence of them appeared at the surface. Although the leaks were hard to locate, they did demonstrate that non-evident leakage does exist even under these conditions. In this area there were 47 leaks found, which were responsible for the wastage of 5.5 m.g.d. The cost of locating and repairing the leaks was $3.11 per m.g. saved, assuming that each leak would have continued for two more years at the same rate if it had not been discovered.

Mr. Nelson's conclusion was that the use of the aquaphone method of locating leakage was most effective in reducing underground waste in water systems, to the end that the investment in large-scale improvements to provide additional water might be materially deferred. The amount of leakage that exists is not likely to be fully realized, although it is usually limited to the smaller mains and services. For good results in such work, however, capable engineering supervision is essential.

Pipe-corrosion studies

Another aspect of New York's water-supply problem, that of the pipe corrosion resulting from the dissolved carbon dioxide in the Catskill supply, was described by Frank E. Hale, director of laboratories of the Department of Water Supply. Dr. Hale's paper was a preliminary report on several years' extensive experimentation upon small pipes of various materials. The object of the experimentation, which has been under way at Ashokan Laboratory, is to find if there is any practicable treatment of the Catskill supply which will relieve the corrosion problem.

The experimental set-up comprised the use of a total of 161 ft. of ¾-in. pipe, through part of which flowed cold water and through the remainder hot water. The flow was such that the contact time was 0.64 hour for the cold water and 0.84 hour for the hot water. The treatments studied included the use of sodium silicate, sodium carbonate, calcium hydroxide and sodium hydroxide. The pipe materials studied were black steel, black wrought iron, galvanized steel, cement lined steel, brass, red brass, and lead. The oxygen consumed during the passage of the water through the pipe was measured to give an index of the amount of corrosion during the test.

Test pieces consisting of 6-in. nipples were built into the test line. After the period of test these nipples were removed and examined. Procedure was such that there were always two nipples of the same material subjected to the same water conditions available for examination. Both were weighed to determine the loss of weight through corrosion, and one was cleaned of clogging material to disclose the appearance of the pipe interior.

Treatment with sodium silicate was of the greatest benefit as far as the loss of weight of pipe material was concerned. However, this treatment resulted in a clogging of the pipe interior that was greater than that with any other treatment. None of the treatment used reduced to any appreciable extent the oxygen consumed in passage. In the order in which they were affected by clogging, the pipe materials were wrought iron, steel, cement-limed steel, galvanized steel, brass and red brass.

Automatic operation of pumps

The use of automatic pumping equipment at Baltimore, together with the telephonic devices for supervision, were described by Leon Small, water engineer, Baltimore, Md. Within recent years the Baltimore water department has completely electrified its pumping stations and has made as much use as possible of automatically operating equipment. Mr. Small emphasized the superior merits of automatic operation, particularly the minimizing of the necessity for the exercise of judgment on the part of an attendant and the consequent minimizing of the possibility of error.

There are three classes of pumping stations in Baltimore. The first class comprises those large stations in which pump operations are manually initiated. In these stations, after the manual initiation all the subsequent steps in the starting or stopping of a pump are followed through automatically. In the second class of station, operation is automatic, although there is supervisory attendance given. The third class of station is completely automatic and free from attendance.

The automatic stations are so designed that the pumping equipment is placed below ground level and the superstructure of the station is small. This type of pumping plant has the virtue of saving the surrounding neighborhood from annoyance due to the noise resulting from motor operations.

In regard to automatic operation in Baltimore it is significant to note that all pumping stations in that city discharge into reservoirs rather than directly into the distribution system.

It was in connection with the operation of the completely automatic and unattended stations that Mr. Small staged a demonstration of the telephonic devices employed to check up on the condition of station operation. Each of these completely automatic stations is equipped with a signaling system that will announce by a coded series of buzzes the exact status of operation. When the station telephone is called, even though there is no operator in attendance, these buzzes are transmitted by telephone to the person making the call. The demonstration at the New York meeting comprised a long-distance telephone call to the Baltimore station with the response amplified by a loud speaker. The operating information thus transmitted automatically from Baltimore to the New York meeting included whether or not the station was operating satisfactorily, which of the two pumps was running, whether water was running into or out from the station reservoir, the pressure on the pump discharge main and the level of water in the reservoir.

In addition to this telephonic system of supervision, the stations are provided with a set of signal lights on the outside of the superstructure, and when station operation has been impaired for any reason a red signal is displayed. In that event any one of the supervisory force passing the station will note the signal and enter to remedy the condition.

Telemetering

The general subject of long-distance indication of measurable quantities, termed "telemetering," was described in some detail by P. S. Wilson, Glen Ridge, N. J. Mr. Wilson's discussion outlined four general types of electrical devices for this purpose. Their development has been particularly rapid during the past ten years, with recent strides following the introduction of the synchronous-motor electric clock and the vacuum tube.

The first type of electric telemeter described, which was also the first type historically to make its appearance, was the step-by-step type. In this instrument there are electrical circuits connecting the receiving and transmitting stations, and for each unit of increase in the quantity being measured one circuit is closed. For each unit of decrease the other circuit is closed. This type of instrument was used as early as 1896 to indicate the level of water in a standpipe at Waltham, Mass. A serious shortcoming of this type of instrument is that an interruption in the electrical circuit will cause it to become inoperative and, when the circuit is re-established, whatever changes have taken place in the meantime will constitute an error in the reading. Further, there is no way of giving an indication that such an interruption has taken place.

Another type of instrument is the so-

called induction type. In this instrument there are two armatures or induction coils at each end of the circuit that are linked by induction. In effect, the system comprises two balanced inductive circuits. Mechanical displacement of the armatures at the transmitting end has the effect of throwing out of balance the two inductive circuits, and the armatures at the receiving end are caused to move by magnetic forces to the extent necessary to bring about a new state of balance. This movement at the receiving end is utilized to give the indication. A virtue of this type of equipment is that power is needed at one end only.

The time-impulse type of circuit was the third type described. In this system of indication the measurable quantity is converted by mechanical and electrical means into a time interval. There are two circuits connecting the transmitting and receiving station, one of which is closed during one part of a time cycle, and during the remainder of the cycle the other circuit is closed. The proportioning of a constant time interval between the two circuits is dependent upon the quantity being measured at the transmitting end. At the receiving end the two circuits bring about rotations in opposite directions of two gear trains. The movement of these gear trains is linked to the position of the receiving indicator in such a way that the indicator is moved when the proportioning of the constant time interval is changed. This instrument depends entirely on the operation of two synchronous-motor clocks, one at the transmitting and one at the receiving end. The electrical transmission system is simple, and the operation of the instrument is unaffected by the variation in carrying current.

A fourth type, the current-voltage type, was briefly described. Its operation is related to the existence of the vacuum tube.

Mr. Wilson emphasized the fact that telemetering was closely associated with supervisory control of equipment at a distance. Telemetering devices have been far more widely used in the electrical and gas industries than they have been used to date in the waterworks field.

Distribution-system problems

The severity of the 1933-1934 winter season emphasized the problems of frozen water pipes and mains throughout the northeastern states. The remedies resorted to by various water departments formed the basis of a paper entitled "Thawing Frozen Service Pipes," presented by Reeves J. Newsom, New York, N. Y. The long interval between winters of unusually low temperatures tends to lull managers of water-distribution systems into a false security against freezing troubles, Mr. Newsom said. The lessons learned during the record winter of 1918 were forgotten, and organizations and equipment were almost completely lacking to meet the situation last winter. Mr. Newsom urged that the subject receive comprehensive study to standardize methods for thawing pipes and to make necessary preparations for organizing emergency equipment and crews. The modern snow-removal programs on city streets have aggravated the problem by removing this cover from over water mains.

Electric energy applied by means of the ordinary welding machine provides the most convenient thawing method, although steam and hot water are occasionally used. These self-contained units are especially useful in isolated sections where central station power is not available. Alternating current has proved more effective than has direct current because of the vibrating action of the alternation. About 25 to 30 kw. of power is advisable.

The efficiency of electric thawing is dependent on the resistance of the pipe. The resistance of iron or steel is ample for the desired heating effect, but it is conceivable that a copper pipe could not be thawed, regardless of the amount of current applied, because of the high conductivity.

Another interesting point is the interference caused by non-conductive joint materials to the electric thawing process. Joints that will not carry current render this method difficult. The cost of thawing varies from $2.50 to $7.50 per service, and the time required is from 3 to 10 min. Thawing by steam costs about the same amount. Thawing of mains requires from ½ to 2 hours.

A discussion by J. Arthur Jensen, Minneapolis, Minn., put the emphasis on keeping pipes from freezing rather than thawing them afterward. He urged the establishing of standard depths for water mains, based on definite data covering depths of freezing in various sections of the country. Depths required in Minneapolis are 8 ft. for mains and 9 ft. for services. This city has an average of 55 frozen services a winter and 1,500 frozen meters, mostly in old or unused buildings.

"Tests of Friction Loss in Distribution Piping" were described in a paper by Burt B. Hodgman, New York, N. Y. The discussion indicated considerable interest in methods of testing, flow coefficients of mains in actual service and the effects of corporation cocks and other irregularities on carrying capacity. Malcolm Pirnie suggested it would be proper to include a test run to determine friction coefficient C at the time a main is installed as a matter of completing the record.

Water purification

A large number of papers were presented at the convention dealing with water-purification topics. One of the most striking concerned the spectrographic determination of minor chemical constituents in water; it was presented by M. M. Braidich and F. H. Emery, of Cleveland, Ohio. The paper was based upon the experience derived from experimental work conducted in Cleveland on the utilization of aluminum dross-fines as a source of raw material for the manufacture of aluminum sulphate in syrup form. As this material is a waste byproduct, arising from the re-melting of scrap and waste aluminum, attention was drawn to the possibility of the introduction of mineral impurities into a water supply coagulated by such a syrup. In order to check the matter, recourse was made to the facilities for spectrographic analysis in the laboratories of the National Smelting Co. Out of the study there grew an investigation of various water supplies throughout the country with regard to minor chemical constituents that would be disclosed by the spectrographic method of analysis.

Monthly composites of daily samples for February and March from 24 cities were examined. The total solids obtained by evaporation of 2-liter samples were used for the analysis. Spectrograms were prepared by burning a few milligrams of this residue in a small cavity in the carbon electrode of the instrument.

Some 30 elements were spectrographically determined on these samples with the following in chemically determinable amounts in all samples: calcium, sodium, magnesium, silicon, aluminum, iron, copper and boron. Strontium was found in all samples. Silver was found to be present in traces in all supplies and to occur in appreciable amounts in the supplies of New York, Atlanta, New Orleans and Denver. Nickel occurred as a spectroscopic trace in all supplies except those of Denver and Indianapolis; in Denver it reached 0.5 p.p.m., and in Indianapolis 0.3 p.p.m. The only sample to contain an appreciable amount of lead was from that of Baltimore, which contained up to 0.3 p.p.m. The only supply that contained enough fluorine to cause any alarm was that of Denver, which contained as much as 0.5 p.p.m. Fluorine, however, could be detected in many of the eastern samples, such as those from Boston, Baltimore and Jacksonville.

Chlorination

Another aspect of water purification to which a great deal of attention was paid was that of chlorination. A symposium on the entire subject was presented with topics ranging from the mechanical problems involved in chlorine dosing to the various types of interferences with the ortho-tolidine test. In regard to such interferences, manganese and nitrites came in for a large share of the discussion. Nitrite interference was discussed in a paper by Roberts Hulbert, Detroit, Mich. The burden of Mr. Hulbert's paper was that nitrites are quite common in water sup-

plies that have been treated by the ammonia-chlorine method, with the nitrite formed through bacterial action. Not only does the presence of nitrite interfere with the accuracy of the ortho-tolidine test for residual chlorine, but the nitrites themselves present a very large chlorine demand. The interference is caused by the fact that nitrites in the water produce the same yellowish color with ortho-tolidine as does chlorine, and a misleading reading is likely to result. Inasmuch as the nitrite color is rather slow to develop and requires the action of light for its formation, Mr. Hulbert recommended that the contact time after the introduction of ortho-tolidine be shortened to about 10 min. instead of the 30 min. recommended in "Standard Methods," and that in the meantime the sample be stored in a dark cabinet.

Discussion of this subject revealed material disagreement among various observers as to the seriousness of nitrite interference and as to the most advisable ways of avoiding it where it does occur.

Other chemicals used for water purification form the subject of a report of the committee on specifications and methods of tests for water-purification chemicals. The committee has prepared a voluminous report on this subject. A great deal of editing and condensation and minor modification are still necessary, however, before the report can become available as a publication sponsored by the association.

The association's committee on filtering materials reported results of a survey of a number of filter plants as to their observations on the behavior of filter beds. The report presented no definite conclusions, but the data presented in the survey indicated that casual observation of filter beds but infrequently revealed depths of penetration of floc greater than 5 or 6 in.

Coagulation of water with iron compound was fully described by A. P. Black, professor of chemistry at the University of Florida, Gainesville, Fla. Professor Black listed the four iron compounds that are in common use: ferric sulphate, chlorinated copperas, ferrous sulphate and ferric chloride. Floc formation proceeds with ferric sulphate and with most iron salts within a wide range of pH. This wider range of alkalinity makes the iron compound far more flexible to use for coagulation than alum.

Waterworks administration

Administrative problems of a wide variety were given attention at the meeting. One of the most interesting phases had to do with the question of purchasing of materials and equipment for waterworks directly and through contractors. A discussion on this topic was led by Paul Hansen, who outlined the positions and preferences of the various parties concerned. Mr. Hansen explained what the position of the engineer is, in that his desire is to produce the best plant possible for the owner at a reasonable cost. From the standpoint of obtaining the type of material or equipment that in his judgment would be best for the installation, the engineer is likely to favor separate contracts for their purchase. On the other hand, the procedure is likely to involve far more detail work for the engineer.

The contractor, on the other hand, is more likely to favor a general contract in which he will also purchase the equipment entering into the job. The manufacturer is more likely to favor direct purchase by the engineer or owner, as he thereby avoids bid-shopping after a general contract has been let.

In discussion, L. R. Howson, of Chicago, Ill., expressed his strong preference for the direct-purchase plan. It makes possible, he said, broader competition and enables the owner or his engineer to assemble the best proposals out of all those submitted. It is unlikely that the best general contract proposal would include all of the best proposals possible for all the constituent operations.

These arguments apply particularly, Mr. Howson said, to major equipment for waterworks, such as pumps. Direct purchase would become cumbersome and impracticable in the case of superstructures where there are involved great numbers of subcontracts and a great variety of materials involved.

Gaining support for filter plant

The administrative problem of developing public support for the construction of a water-purification plant in Milwaukee was presented by J. P. Schwada, city engineer of Milwaukee. Mr. Schwada described the shortcomings of Milwaukee water as the presence of tastes and odors, gelatinous particles and actual contamination, as evidenced by a high infant death rate of diarrhea enteritis. A filtration plant was recommended as early as 1921 in an engineering report by J. W. Ellms, but there has been opposition to its construction since that date. At one time the opposition centered about the opinion of local chemists that developments in chemistry were proceeding at such a rapid pace that it would be possible within a short while to install a plant capable of a high degree of purification at a cost far below that necessary for orthodox water-purification plants. Another obstacle in the public mind has been a number of awards that Milwaukee has received for its good health record. It has been necessary to educate the public to the fact that the good health records bore a serious blemish, even in the report of the prize-awarding body, in the high infant death rate from diarrhea. It was also possible to demonstrate the close correlation between this infant death rate and the variations in the quality of the water supply.

Milwaukee has now decided to go ahead with the construction of its filter plant. It is estimated that the increase in cost to the consumer will be but 10 to 12 per cent of the water bill, amounting to about 7c. per month for 92 per cent of the consumers.

An administrative problem of a different nature is presented by the value of water rights. Tendencies in their evaluation were discussed by Robert E. Horton, Voorheesville, N. Y. He depicted water-right values as comparable to real estate values except that factors of appraisers' judgment and near-by sales, used so much in establishing real estate values, must be supplemented by engineering data and calculations for evaluating the additional factors encountered in water-rights settlement. However, he felt that engineering data could profitably be supplemented by sound common sense judgment.

New questions of law and policy in the making of rates for water service were the topic given discussion by W. L. Ransom, an attorney of New York City. Mr. Ransom characterized the economic developments of the last three years as being charged with meaning for the waterworks industry. Particularly is this so in regard to the new relationship of the federal government to waterworks problems. Although water service has heretofore been considered largely local in its nature, there are now codes of fair competition called for by the federal government, and the federal government is also intervening in waterworks finance. He strongly urged that adequate rates be made possible for water service so that the public debt would not be increased. He also called attention to the diminishing use of the valuation engineer and the increasing use of historical costs in determining rate bases.

Public works and waterworks

The experiences of the past year in connection with the public-works administration and waterworks improvement were reviewed by W. T. Chevalier, New York, N. Y. Colonel Chevalier deplored the time that had been wasted last fall in organizing the public-works administration and the resistance that there had been to the program in political circles even after the public-works act had been passed. Another factor that had handicapped the rapid progress of the public-works program had been the preoccupation of the government and the country at large with the NRA. Colonel Chevalier strongly urged, however, that with the losses in time and effectiveness now behind us, it is highly essential that public-works construction be encouraged as a measure of recovery. The public-works device, however, finds continuity essential if it is to be successful in vitalizing and revitalizing private investment of capital.

Letters to the Editor

Construction's Part in Recovery

Sir—It is time for the construction industry to begin analysis of the causes of *why* it has been one of the few basic industries to share so slimly in the economic recovery under way for some time now. Not to do so may delay the ultimate prosperity which is its right in company with the other businesses of the country.

The first to suffer from a slump, the natural economic right of construction is to be the first in recovery. Public works have been a will-o'-the-wisp. Their chief value has been to furnish summations amounting to millions of dollars, which newspapers, with the best of intentions, have carried in headlines as harbingers of returning construction. They did not fully understand that the normal summations of building must be in billions to be a real ground for prosperity. Again, the builder has not had a say in the system and speed needed in allocation of these public funds. Is not a great deal of the fault their own through a devastating lack of the art of self-defense?

The duty of the construction industry is to bring forward a true set of values to offer the investor, and then to sell him the investment as one offering future benefits in return for the present spending of his money. This is not a selfish duty, but a patriotic one. The resumption of activity in the industry would then absorb its normal quota of four millions or more working men, and the transient bureaus and other relief agencies would soon become unneeded.

The problem should be attacked with the vigor and speed characteristic of the constructor in his normal work. As a suggestion, a board of investigation and publicity could be selected of practical engineers and builders who have a proven record back of them for getting results regardless of the odds. The facts should be assembled as to what constitutes the brakes within the building industry itself, whether codes, burglarious trade practices, or any dog-in-the-manger attitude of any units in the construction machine. More important, prospective customers for building, such as municipalities, large and small industrial producers, home builders, etc., should be approached and their reasons registered as to why their construction needs are not being filled under present conditions. These sets of facts would then provide efficient ammunition for warfare on unhealthy conditions that have evolved under stress of the times within the construction industry itself, and should prove even more effective against those that have unjustly been imposed by outside influences. With the sincere cooperation of builders, this board could do much by proper publicity toward restoring reasonable trade practices, and the investing public would again find the services of the builder attractive again. But for success, men of action must be on this board, the kind who like to fight bare-knuckled for what they know to be right.

E. L. ROBERTS.

Columbia, S. C.
April 28, 1934.

Tests on Laminated Concrete Slabs

Sir—Subsequent to the friction tests made on lubricated concrete surfaces which were described in your issue of Oct. 12, 1933, p. 442, under the title "Friction of Lubricants for Laminated Concrete," these tests were extended to include pressures from 100 to 300 lb. per sq. in. To bring this matter to date and make available additional data for those interested in the subject, the information obtained from the supplementary tests is outlined in the following.

As described in detail in the original article, these tests were made to indicate the behavior of the laminated concrete slabs that are being used to pave the upstream faces of the rockfill dams now under construction by the Los Angeles County Flood Control District on the San Gabriel River. Briefly, the test consists of moving a small concrete 5x6x4-in. block between two larger concrete 10x10x3-in. blocks. The contact surface of one large block and the opposing surface of the smaller block were coated with $\frac{1}{16}$ in. of treated asphalt with a 190-deg. F. melting point. The blocks were held together in a steel frame, and a static load was applied with a steel coil spring. A standard compression testing machine was used to force the smaller block to move between the larger blocks at a rate of 0.05 in. per minute for a distance of $\frac{1}{2}$ in.

The subsequent series of tests, using the higher pressures, was made with Gunite blocks and rougher surfaces than were used in the previous tests with smooth concrete surfaces. The slight difference in surface smoothness accounts for the small difference in the friction coefficient under the 100-lb. pressure that marked the final pressure for the first series and an intermediate pressure for the recent series. However, the curve continues to show that the higher pressures reduce the coefficient of friction, and the lower pressures increase it. When plotted on logarithmic paper, this graph approaches a straight line.

The coefficient of friction continues to decrease, with the pressure increased up to 300 lb. per sq. in., and is correspondingly higher when the pressures are reduced to 50 lb., using a range of temperature between 55 and 78 deg. F. The same relative results were obtained when the pressure was increased from low to high or decreased from high to low. These pressures, the force required and the resulting coefficient of friction for the recent series of tests are indicated in the accompanying tabulation.

The starting friction, or force required to produce motion for the static load, is apparently dependent upon the binding quality of the lubricant, which, in turn, is dependent upon the temperature. Constant internal temperature of the lubricant produces more uniform decrease of coefficient with an increase of pressure. Increase of the internal temperature of the lubricant tends to decrease the force of friction.

When movement begins, the increase of pressure or static load has little effect upon the force of friction or pulling force. The above conclusions follow generally the previous results.

E. C. EATON,
Chief Engineer,
Los Angeles County Flood Control District.
Los Angeles, Calif.,
April 19, 1934.

HIGH-PRESSURE COEFFICIENT OF FRICTION ON CONCRETE AND TREATED ASPHALT

	50 Lb. Per Sq.In.		100 Lb. Per Sq.In.		200 Lb. Per Sq.In.		300 Lb. Per Sq.In.	
	F	*C*	*F*	*C*	*F*	*C*	*F*	*C*
Test No. 1 at 70° F. Concrete to concrete (steel-troweled blocks).	3,424	— .95	5,878	— .82	....	....	....	....
Test No. 2 at 70° F. Treated asphalt on concrete blocks. Melting Pt. 190° F.	1,176	— .33	1,144	— .16	....	....	....	....
Test No. 3 at 70° F. Treated asphalt on Gunite blocks. Melting Pt., 190° F.	2,350	— .81	2,660	— .46	3,275	— .28	3,683	— .21
Test No. 4 at 70° F. Treated asphalt on Gunite blocks. Melting Pt., 190° F.	....	....	3,867	— .67	4,612	— .40	4,069	— .23
Test No. 5 at 55 to 78° F. Treated asphalt on Gunite blocks. Melting Pt., 190° F.	....	....	....	....	....	....	5,600	— .29

Notes: All tests began with low pressure and were increased to high, excepting No. 4, which was reversed.
All moving oads at rate of .05 in. per minute.
All moving loads in two opposite directions excepting test No. 4, which included four directions.
F = Average moving load in pounds.
C = Coefficient of friction.
Blocks 5x6x4 in. and 6x6x4 in.
April 14, 1934.

ENGINEERING NEWS-RECORD

EDITOR—F. E. Schmitt. EDITORIAL STAFF—V. T. Boughton, W. G. Bowman, F. W. Herring, C. S. Hill, H. W. Richardson, J. I. Ballard, W. W. De Berard, N. A. Bowers.

Published by McGraw-Hill Publishing Company, Inc.
Editorial and Publishing Offices at 330 West 42d Street, New York

June 14, 1934

Volume 112, No. 24

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Dangers from Poor Plumbing

IN A DRAMATIC WAY, emphasis has again been placed upon the hazard to health presented by faulty building plumbing by the decision of the American Water Works Association to demand from convention hotels in the future definite assurance that contamination cannot enter the drinking water supply through badly arranged or poorly maintained piping. Although the organization, like the New England Water Works Association and the American Public Health Association, has for many years combated the cross-connection of potable water supplies with any other piping systems, its attention was forcibly directed to the dangers of exposing purified water to contamination within the interiors of buildings by the analysis presented during the convention of the physical background of the amebic dysentery epidemic that focused at Chicago last year. That an organization whose activities are so closely bound up with problems of public health should demand assurances of safety from the hotels it patronize is entirely proper. It is to be hoped that other organizations will follow the example.

A Dream Come True

DENVER'S DREAM of a through line to the Pacific Coast is to be realized this week with the opening of the Dotsero Cutoff connecting the Denver and Salt Lake line west of Moffat Tunnel with the main line of the Denver & Rio Grande Western. This shorter line to the West is not the direct line to Salt Lake that was visualized so many years ago by David H. Moffat when he began promoting the Denver & Salt Lake R. R., and even with the tunnel built with public money a few years ago, it is not an attractive line in so far as transcontinental freight movement is concerned, but for passenger service is takes several hours out of the present running time between Denver and Salt Lake City. Many bitter disappointments and much disillusionment lie back of the present accomplishment, but now that the vision in large measure has been realized they will be the more easily forgotten. Most communities have similar projects that become hobbies which ultimately they will build regardless of cold economic considerations. Denver's differs only in that it got involved with privately-owned railroads and had to be financed in such a manner as would permit of leasing it to a railroad company.

Centralized Code Activities

ADMINISTRATION of the various divisional and subdivisional construction codes is going to be a complicated and expensive procedure. Hundreds of local administrative authorities are being formed throughout the country, and others will come into being as additional codes are approved. Financed only by a portion of contract registration fees, many of these local bodies will be handicapped by lack of funds in the full and effective administration of codes, especially in areas where construction volume is small. Wisely anticipating such a situation, code authorities in some localities have banded together to form central administrative offices. Charleston, W. Va., and Cincinnati are examples of this centralized office idea. In these cities local offices of the contractors' association have been designated as code headquarters. Each code administrator has desk space as required, but all use the common office facilities, such as stenographic and phone service. The association personnel performs many detail code administration duties under the direction of the various administrators. The office also provides a central bid depository to facilitate filing of bids required by many code chapters. This plan of a centralized administration office is worthy of the consideration of all local code bodies.

A New Research Tool

A NOTABLE OBSERVATION of engineers who have followed the development of experience in carrying out the five-year construction plan of the Soviet Union has been the purposeful turn of its direction to the help of research, rationalization and standardization. Active creation has been, and now is, in progress by numerous agencies to advance knowledge of materials and forces that contribute to better economics and technique in engineering design and construction. An interesting example of this activity and of the distinctly wholesale manner in which it is conducted is furnished by the great laboratory of hydrotechnics described in this issue. It is probable that research in so many phases of hydraulic science has not been so fully centralized elsewhere among the nations. Whether this heading-up of research talent and facilities offers any clear superiority to the system of independent institutional and government laboratories that prevails elsewhere in Europe and in America may reasonably be questioned. There are plain advantages and disadvantages to be perceived in any centralization of experimental and inventive activities. But the important fact at the moment is that hydraulic science has been enriched by a powerful contribution to its empirical helps by the great Russian laboratory of hydrotechnics.

Engineer and Lawgiver

AN INCIDENT of the current commencement season, the conferring of an added doctorate by the University of Wyoming on Elwood Mead, head of the federal reclamation service, turns back the pages to the beginning of a chapter in irrigation history. Nearly fifty years ago, when Wyoming was about to emerge into statehood, Mead was named territorial engineer. His chief duty was to administer the water rights of those who used the streams for growing crops on arid lands. The doctrine of prior appropriation had long before become established in the West, but its practical application was a wild tangle of claims, quarrels and litigation that made it nearly useless. Mead, through his work, came to understand these conditions thoroughly. He saw the many evils of the process of court adjudication of stream rights, in which fact was determined by the maneuverings of cunning lawyers rather than by the measurements of engineers. When the constitution of the new state was to be drafted, Mead was called upon to write its water code. He produced a chapter of

law that laid the foundation of a new era in irrigation history. Based on the principle that the waters of the state are the possession of its people, that appropriation of water should attach indivisibly to the land on which it is put to beneficial use, that the waters and lands should be surveyed by the state engineer and that water permits should be granted by a control board only after such survey, it clarified the confused system of water appropriation and made it a simple and definitely recorded matter of administrative procedure. The Wyoming code of water law set a model that was followed not only at home but also abroad. Modern irrigation development was made possible by its influence. In citing Dr. Mead as both lawgiver and engineer, the Laramie academicians honored an achievement in which the engineering profession as well as the citizens of Wyoming may justly take pride.

First Claim to Safety

IF CHILDREN are required by law to spend their days attending schools, it is the duty of the community to provide safe school buildings. Children unquestionably have the first claim on safety, and the best practices of structural engineering are none too extreme even when they conflict with desires for economy or for architectural effect.

California has good occasion to bear these principles in mind, for its present problem of school safety involves the lives of many thousands of children, as against the expenditure of many millions of dollars of public money. The Long Beach earthquake of a year ago revealed the extent to which the schools of the state are lacking in security, and accordingly a law was passed that requires all schools, old as well as new, to be made earthquake-resistant. The law has already closed scores of schools, in the San Francisco as well as the Los Angeles region. But inertia and parsimony are powerful enemies of the necessary reform action, as was demonstrated recently in the negative vote of Los Angeles citizens on a bond issue for school reconstruction as required for safety. Rumors of labor union opposition to the bond issue, on the ground that the dominance of the unions was not guaranteed, merely strengthen the argument that if California schools are to be made safe a more insistent campaign must be waged, and that engineers in particular must act vigorously in demanding that the children be given safe schools.

New York City has a problem of equal gravity, with fire and panic as hazards rather than earthquake. Facts recently developed show that a hundred or more of its public school buildings are not fire-resistant. City officials make the defense that all these schools are safe, because, wonderfully enough, special fire drills show that each of them can be emptied in so-and-so-many minutes; but a like argument would have exculpated the Iroquois Theater of tragic memory, as well as numberless halls and dwellings that in the test of emergency became the funeral pyres of their occupants.

The principles of safe building construction are well known; for buildings of public assembly they have been worked out with particular care. Nowhere do these principles claim application more imperatively than in the field of schools, and no citizen should rest content with anything less than the most thorough provision of safety that modern constructional skill can provide. Let us safeguard the children first of all.

More Than Engineering

FACTORS other than engineering are so deeply involved in many public-works projects that they justify thorough attention by the engineer. The conscientious planner always seeks first for the full facts, and bases his project upon them. But not often can any project of magnitude be reduced to such simple terms that the several alternate plans which present themselves are capable of being compared on a dollars-and-cents basis. Factors other than engineering frequently make the "most desirable" scheme impracticable.

Thus, in the consideration of better transportation facilities westward out of the Chicago downtown Loop district, many different proposals have been made. Elevated highways, one-way streets with grade separations (*ENR*, Jan. 14, 1932, p. 67), streets with traffic-control facilities (*ENR*, Jan. 4, 1934, p. 25) and even a grandiose depressed parkway in a strip two blocks wide have been advocated. But in each case the progress or failure of a particular scheme has been controlled by non-engineering considerations. And these "outside" factors are quite likely to be of primary weight in the ultimate decision.

Reference to some of the conditions that prevented acceptance of the elevated highway project will illustrate the point. First, the proposal came from a small minority party in the city council. Next, it was not worked out with the cooperation or approval of the Chicago Plan Commission—and no great improvement of recent years has gone through without the commission's approval.

In addition, the project depends for financing on the combined efforts of city, county and state, and though the legislature has authorized a combined organization none has yet been set up. City, state and county have rarely worked together in full harmony. Labor unions and contractors of Chicago do not welcome the entry of the state into Cook County, much less into the city. Under such conditions, and with all local interests pulling for their own particular routes and methods, putting through this particular traffic betterment has little chance of success, regardless of need and merit.

To such a pass does a multiplicity of governments and private organizations bring us. The solution appears to rest in a reform of procedure under which a single agency would be designated to do the job in detail, after referendum decision of general policy. Questions between underground, surface, depressed or elevated routes are not matters on which the voter is qualified to pass. But he can say that he wants better service and is willing to bear his share of the cost—and that is all.

If the average citizen must utilize his voting power to settle technical questions, let the process be made simple for him; otherwise the vote becomes merely an expression of sentiment guided (usually) by misleading publicity effort. As for the private organizations that hamper the proper adjustment of public issues, we can hardly hope to elminate their disturbing influence. But, while we wait for the millennium of harmonious and unselfish striving for public improvement and for the great day when superfluous local governments will be wiped out by consolidation, we may obtain reasonably effective results by allocating responsibility for a project to a specific body charged with planning and execution, and equipped with adequate authority to bring about results.

CURRENT NEWS

Highway Fund Act Restricts Diversion of Gas Tax Receipts

TO CHECK diversion of gasoline tax receipts to purposes other than road construction and maintenance, the Cartwright bill appropriating $200,000,000 for the new fiscal year, as finally enacted, restricts federal aid in subsequent years to states that apply to the highways the amounts specified by law. This condition attaches to the $125,000,000 authorized for appropriation in each of the fiscal years 1936 and 1937, to be matched dollar for dollar by the states among which it is apportioned. No strings are attached to the outright appropriation of $200,000,000 for the year commencing July 1, which includes $100,000,000 set up by President Roosevelt for road construction in the $1,172,000,000 deficiency bill.

The highway bill carries an emergency fund of $10,000,000 for repair and reconstruction of federal-aid roads damaged by floods, earthquakes and landslides and a lump sum of $24,000,000 for roads and trails in national parks and forests, public lands and Indian reservations. For the same purpose a like amount is authorized for appropriation in each of the years 1936 and 1937, distributed as follows: national forests, $10,000,000; national parks, $7,500,000; public lands, $2,500,000; and Indian lands, $4,000,000. By a late amendment the Bureau of Public Roads is authorized to expend $75,000 for continuing cooperative survey work with Central American countries on the Inter-American highway.

The American Motorists Association and the National Highway Users Conference sponsored the provision to protect revenues from gas tax and motor registration and license fees from diversion by states becoming desperate because of the diminishing returns from property taxes. More than $200,000,000 of approximately $600,000,000 collected by the states now is diverted for other purposes. In many states statutory provisions requiring that the money be spent on highways have been ignored. In New York, for example, $50,000,000 out of $80,000,000 was diverted in 1932 without amending the law.

The action of Congress to deprive of federal aid states that do not respect the terms of their present laws precludes amendment to defeat the congressional intent. There was mild opposition on the ground that it is no business of Congress how the states spend their money but sentiment generally is opposed to diversion of road funds. As the U. S. is the worst offender, collecting considerably more from its 1c levy than is normally appropriated to highways, the curb on the states presages a drive for repeal of the federal tax. Federal gas tax collections in the fiscal year ended in June, 1933, totaled $124,000,000. Regular federal-aid disbursements totaled only $101,000,000 but in that year the emergency highway program added $62,000,000.

New Orleans Ordinance Bars Cross Connection of Pipes

An ordinance prohibiting cross-connection between water pipes of the sewerage and water board and the pipes of any private source of water supply in New Orleans was adopted by the city council on May 28. The ordinance goes into effect in six months, but effective immediately no permits for such cross-connections will be issued. At a hearing the ordinance was approved by a number of organizations, including the Association of Commerce, city and state boards of health, United States Public Health Service, the Louisiana Rating and Fire Prevention Bureau, New Orleans Association of Master Plumbers and the Building Owners' and Managers' Association. Representatives of several industries, while not opposing the ordinance, mentioned the hardships it would entail on their concerns, but agreed to make the necessary adjustments in their water supply systems.

Camden Subway Contract Let

The Triest Contracting Co., New York City, on June 9 was awarded contract No. 3 for part of the rapid transit subway in Camden, N. J., a part of the high-speed transit line across the Delaware River Bridge. This particular contract involves the building of a station under the present railroad station at Broadway, and a subway line under 5th St. from Federal St., to Pennsylvania Railroad tracks and then to Haddon Ave. and Carman St. The subway is being built by the Delaware River Joint Commissioners, Modjeski, Masters and Case, consulting engineers. The contract price is $957,694.

Twin-City District Accepts PWA Board For Sewer Project

THE board of trustees for the Minneapolis-St. Paul Sanitary District, on June 11, accepted the recommendation of the Public Works Administrator Ickes that it employ a board of engineers named by the PWA (*ENR*, June 7, p. 752) to supervise the design and construction of its $18,000,000 sewage disposal project instead of executing a proposed contract for engineering services with the firm of Consoer, Townsend, Older & Quinlan. The proposed contract was approved several weeks ago by a 4 to 3 vote, and following the divided vote the contract was the subject of controversey in the Twin Cities inasmuch as it was opposed by the three members from Minneapolis and approved by the three members from St. Paul. The one member from outside the cities cast the deciding vote.

Since that vote was taken the new mayor and commissioner of public works of St. Paul have taken their place on the board.

The board named by Mr. Ickes is composed of Brig. Gen. Charles W. Kutz, Corps of Engineers, U. S. Army (Retired), chairman; Frederick Bass, dean of engineering, University of Minnesota; Darwin W. Townsend of the firm of Consoer, Townsend, Older & Quinlan; and George W. Fuller, New York, who had been the choice of the Minneapolis member of the board of trustees.

Bids already have been called by the trustees on two sections of the intercepting sewers.

Several Construction Code Budgets Approved by NRA Administration

Washington Correspondence

The first of numerous budgets for Code Authorities under the Construction Code and its divisions will become effective June 15, at the expiration of a waiting period of 10 days following the public announcement of the budgets submitted. The other divisions will follow in rapid succession. The largest single item, the 1/10 of 1 per cent of cost assessed by the General Contractors' Division, which reaches an estimated $2,750,000, goes into force throughout the country on Monday, June 18, and its funds will be distributed through 49 state boards and 290 local boards. Other divisions of the industries whose budgets go into effect at the same time are: Construction Industry (under Chapter I), $290,300, based on value of the work or services registered; electrical contracting, $455,624, based on 1 per cent of productive labor payrolls; elevator manufacturing, $58,433.32, based on 1/5 of 1 per cent of gross sales billed; tile contracting, $78,801.42, based on percentage starting at 1 per cent of contracts up to $50,000; painting, paperhanging and decorating division, $620,000, based on ½ of 1 per cent of gross volume of sales.

The total of code assessments of the entire construction industry and its divisions is expected to total $10,000,000, and this huge sum is being approved only for six months, and in the meantime the Construction Code Authority has been specifically directed by NRA to make a study of the needs of the code authorities for such a sum and to recommend any changes that may seem proper, to be acted on by NRA in any revision of the budgets at a later date. This study will include the specific budgets of the various divisions and also the distribution of the money. For instance, under the General Contractors' Division there are 49 state boards, with $16,000 each annually to carry on their work, and 290 local boards with $5,400 each annually for their total expenses, although a large proportion of the work will have to be done by the local boards; it has been suggested that the state boards be pared down, the local boards be given larger budgets.

Hearing on St. Louis Sewer District Scheduled for July 2

Circuit Judge Mueller of St. Louis County, Mo., has set July 2 as the date for hearing objections to the proposed Sanitary Sewer District of St. Louis County, which contemplates the construction of a series of trunk sanitary and storm sewers to cost about $5,878,000. An application for a PWA grant of $1,075,000 and loan of $4,325,000 is pending in Washington, having been passed upon favorably by the Missouri State Advisory Committee of the PWA. A report fixing the boundaries of the district and setting forth a detailed plan for 120 miles of trunk sewers and declaring that the improvements are urgently needed for the preservation of public health and welfare has been filed with Judge Mueller by W. W. Horner, consulting engineer. Roughly the proposed district is bounded by Lindbergh Drive on west, Gravois Creek on the south, Maline Creek on the north and the St. Louis city limits on the east. The area is about 100 square miles and population to be served approximately 175,000. Benefitted real estate is assessed at about $155,000,000.

Washington Notes

By Paul Wooton
Washington Correspondent

Revision of the questionnaire for the Federal Power Commission's general survey is in progress following suggestions and criticisms obtained from typical plants. The questionnaire, as originally drafted, was taken by Robert H. Barkley, of the Commission's staff, to a number of private and public operators in the east. Various changes were suggested so as to bring the questionnaire as nearly as possible into a form that can be answered most readily.

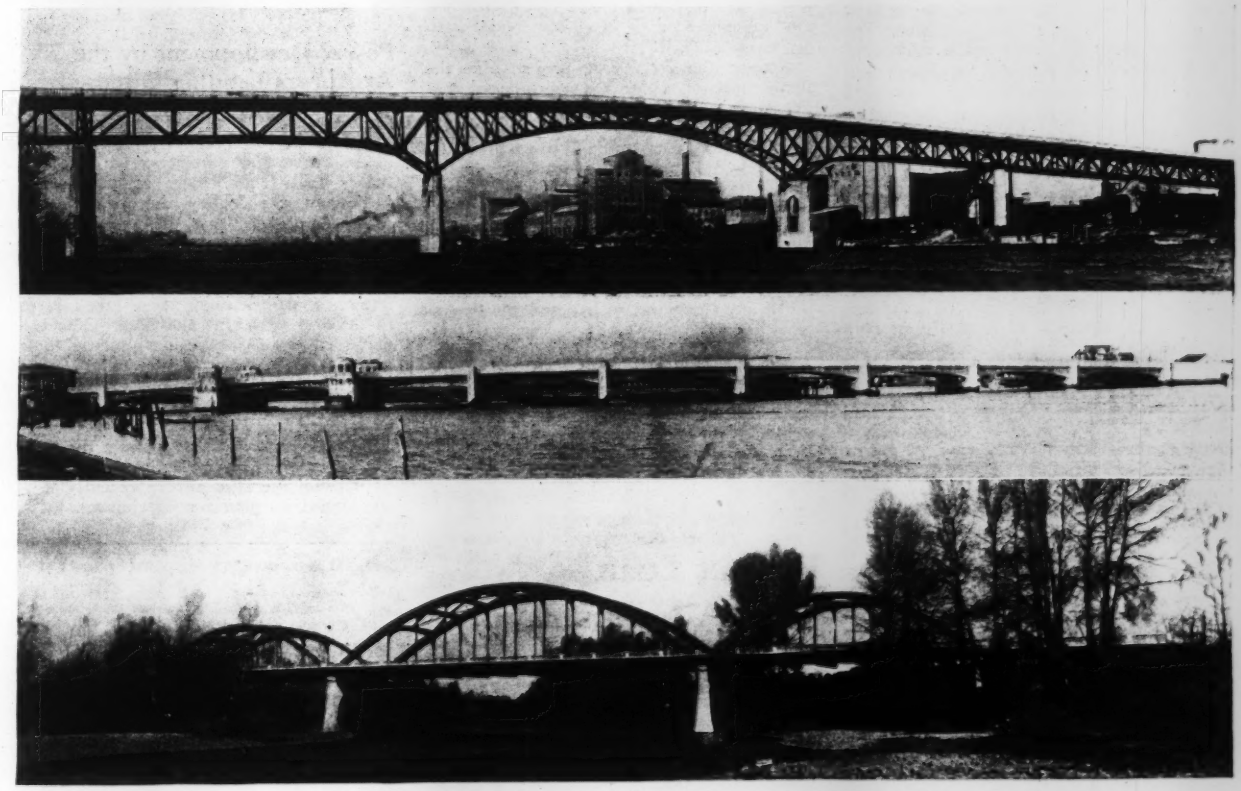
The Commission is giving active consideration at present to the exact scope which the power and rate surveys are to cover. Each of these surveys will have to be brought within the limits of the available appropriations and within such time limits as will allow results to get promptly to industry. Every effort is being made to avoid the gathering of information that cannot be utilized effectively.

Legal limitations upon the use by one bureau of information gathered by another bureau is making it necessary for the Federal Power Commission to gather anew much data already in the hands of the Bureau of the Census and of the Federal Trade Commission. Studies of the statutes involved have been made but it has been decided that the Federal Power Commission must gather its own data.

The proposal of the American Engineering Council for including a nation-wide program of surveying and mapping in the public works program has been offered in the Senate as an amendment to the deficiency bill which carries the $500,000,000 public works fund for the ensuing fiscal year. The mapping program calls for an allotment of $21,750,000 and is sponsored in the House by Representative Cole, of Maryland.

A Senate bill amending the Inland Waterways Act to include the Columbia and Snake Rivers under its barge lines provisions, was passed by the House June 11. It now goes to the President.

The War Department has announced award of contracts totalling nearly $500,000 for construction and rivers and harbors work in New England.



THE THREE MOST BEAUTIFUL STEEL BRIDGES BUILT LAST YEAR

The three most beautiful steel bridges built during 1933, each selected from a cost classification by a jury named by the American Institute of Steel Construction, are, shown above from top to bottom: the Cedar St. Bridge over the Illinois River, Peoria, Ill., the Shark River highway bridge, New Jersey, and the Dr. John D. McLoughlin bridge at Portland, Ore. The Peoria bridge, selected as the most beautiful in Class A, costing more than $1,000,000, was designed by the Strauss Engineering Co. and erected by the McClintic-Marshall Corp. The South Tenth St. bridge over the Monongahela River at Pittsburgh, designed by George S. Richardson, bridge engineer of Allegheny Co., received honorable mention.

The Shark River bridge, on the New Jersey shore, winner of Class B, costing between $250,000 and $1,000,000 was designed by Morris Goodkind, bridge engineer, New Jersey State Highway Department. American Bridge Co. erected the structure. The Shrewsbury River bridge at Seabright, N. J., designed and built by the same parties, received honorable mention. The prize in the small bridge class went to the Portland bridge, designed by C. B. McCullough, bridge engineer, Oregon State Highway Department. It was erected by Poole & McGonigle of Portland. Honorable mention in this class was given the Port Clinton bridge over the Portage River, Port Clinton, Ohio, designed by J. R. Burkey of the Ohio Highway Department.

The jury making the awards consisted of Gustav Lindenthal, consulting engineer, New York; Prof. C. T. Schwarze, New York University; Philip Sawyer, of York and Sawyer, architects, New York; Ralph E. Winslow, Rensselaer Polytechnic Institute; and Russell F. Whitehead, editor of "Pencil Points," New York.

Rapid Progress on Caissons of San Francisco Bay Bridge

The caisson being sunk for pier 3 of the San Francisco-Oakland Bay Bridge reached its final position on May 9 with its cutting edge at El.—223.7. Sealing operations in twelve wells in the center of this caisson were completed on May 12 and after allowing the seal to set seven days the eight wells on each end of the caisson were cleaned out down to rock foundation. Sealing of the caisson as a whole was completed on June 2. The deepest point in this caisson is at El.—238, concrete having been placed on rock at this level. This exceeds by more than 60 ft. the record made on the Atchafalaya River Bridge in Louisiana described in *ENR*, Dec. 28, 1933, p. 776.

As to the other piers of the West Bay crossing, on pier 2 erection of the steel tower was to be completed, except for riveting, with the placing of saddle castings on June 13. On pier 4 the cutting edge on June 9 was at El.—210 and the bottom was being cleaned preparatory to placing the seal. One pier 5 the seal was completed June 3 with concrete in the bottom averaging El.—110. On pier 6 the final concrete in the fenders was placed on May 29. This pier has been ready for steel for some time but as a matter of convenience it is planned to defer steel erection on it until the tower is completed on pier 3.

New Bridge for Sacramento

Bids will be considered by the California State Highway Commission at Sacramento on June 27th to construct the new M Street bridge over the Sacramento River in the city of Sacramento, replacing the present obsolete structure. The bridge, to cost approximately $1,000,000, will be a combination rail and highway structure, consisting of one 209-ft. through steel truss lift span; one 192-ft. through steel truss fixed span; one 167-ft. through steel truss fixed span and four steel girder spans from 34 to 35 ft. in length. The clear width of the bridge will be 52 ft., providing for railroad tracks in the center and two lanes of automobile traffic on each side.

Revenue Bond Act Allowing PWA Loans Upheld in Michigan

The Michigan Supreme Court on June 4 affirmed Michigan's self-liquidating revenue bond act of 1933, clearing the way for final decision by PWA officials in Washington on PWA projects in Michigan. The revenue act was passed to authorize municipalities to construct sewage disposal plants and other projects to be financed with revenue bonds requiring only a favorable vote of the governing body for issuance.

The Supreme Court decision terminated three test cases involving the Ann Arbor and Charlevoix sewage disposal plants and the Traverse City municipal harbor and park development, in which numerous objections to the statute were raised. The findings of the Court pointed out that the revenue bonds, being secured only by the revenues of the projects, do not increase the municipal debt nor affect the taxation limit. The bonds authorized under this act are not subject to limitations and provisions established for the municipal and quasi-municipal subdivisions.

Among the 36 PWA projects, in the furtherance of which the court decision is expected to aid, are the Detroit subway system, $87,854,000; Detroit swimming pools, $1,200,000; Ludington yacht basin, $236,384; Dearborn swimming pools, $368,760; Traverse City yacht basin, $450,000; Holland swamp reclamation, $350,000; Mackinaw bridge and causeways, $30,000,000; Sault Ste. Marie international bridge, $3,500,000; Port Huron international bridge, $3,463,000. Included in the sewage disposal plants and sewer systems proposed are: Ann Arbor, $600,000; Birmingham, $377,000; Monroe, $532,695; Battle Creek, $565,000; Mt. Clemens, $675,000; Kent County, $350,000. A metropolitan sewage disposal project proposed for the Detroit metropolitan area is estimated to cost $15,000,000. The total of Michigan non-Federal PWA projects, for which applications has been prepared, exceeds $133,000,000.

More Revenue Needed to Meet Saint Louis Public Works Bonds

City Comptroller Louis Nolte of St. Louis has declared that he will not certify that the city is prepared to meet interest and principal payments on the $16,100,000 in public works bonds voted May 15 until the city has provided additional revenue to take care of these obligations. The Board of Estimate & Apportionment on June 5, after a protest by Nolte, postponed action on a proposed ordinance to authorize the sale of the bonds. The board, composed of Nolte, Mayor Bernard F. Dickmann, and Walter J. G. Neun, president of the Board of Aldermen, will not act on the bill until after the Board of Aldermen has decided the fate of various revenue-raising measures now before that body. In declaring his opposition to the bonds, unless the city is prepared to finance the interest and maturities, Nolte pointed out that the city this year for the first time is faced with the prospects of a deficit in its bond sinking fund amounting to $2,452,907. Nolte has opposed the bond issue from the outset on the grounds that the city should not increase its bonded indebtedness until ample provisions are made to take care of existing debt obligations.

Power Development by the TVA At Aurora Landing Opposed

Development of power at Aurora Landing, Ky., on the Tennessee River about 44 miles above the confluence of the Tennessee and Ohio rivers as proposed by the Tennessee Valley Authority (*ENR*, May 24, p. 677) was opposed before the Federal Power Commission in Washington on May 23 by the Southern Industries and Utilities, Inc., at a hearing on the latter company's application for a license to develop power at that site. The company has made preliminary plans to develop the site under a preliminary permit issued by the power commission some time ago. That permit expired last August and at the time the Tennessee Valley Authority announced that it would oppose the granting of a 50-year license to the company to develop the site. More recently it has announced its plan for development of the site.

San Francisco Housing Project Loan Rescinded by Public Works Administration

An allocation of $3,230,000 for a housing project in San Francisco, known as the Roosevelt Terrace Apartments, has been rescinded by the Public Works Administration because the applicant was unable to comply with the conditions specified in the allotment. The allotment was made on October 5, 1933, specifying that the Federal loan to the limited dividend housing corporation which proposed to erect the project would be made subject to terms of a satisfactory contract between the corporation and the Public Works Administrator, requiring security to be provided by the applicant. Subsequently the applicant made efforts to provide the security but was unable to furnish the necessary equity to protect the Government for the amount of the requested loan. In rescinding the allotment the PWA transferred the money to the credit of the Public Works Emergency Housing Corp.

Loans changed to grants only

Recipients of ten allotments of loans and grants for construction of non-Federal projects have requested that their allotments be changed to grants only of 30 per cent of the cost of labor and materials to be used on the projects. The changes have been made as requested by the PWA, thus releasing $1,441,980 for re-allotment to other non-Federal projects. The recipients of the original loan and grant allotment have notified PWA they now are able to sell their bonds in the regular way in the private investment market and will not need a loan from the Public Works Administration. Following is a list of the projects with amounts of original loans and grants: Boscobel, Wis., $48,250 for theatre and gymnasium; Neosho, Mo., $41,000 for sewage disposal plant; Lexington, Ky., $1,382,000 for storm water sewer system, $61,000 for additions to sewage disposal plant, $203,000 for public health center, and city jail, $146,000 for extension to sanitary sewer system; North Haven, Maine, $5,800 for improvement to water works system; Menomonee Falls, Wis., $21,000 for intercepting sewer and sewage disposal plant; Stanton County, Kansas, $65,500 for construction of school building; and Carthage, Mo., $30,000 for construction of a concrete viaduct.

Increases aggregating $499,000 have been made by PWA on previously awarded loan and grant allotments to the State Highway Commission of Oregon for construction of five bridges on the Oregon Coast Highway. The total amount originally allotted for these bridges was $5,103,000. The increases were made at the request of the State Highway Commission, which found on receipt of bids for these projects that the estimates of cost on which the original allotments were made were about 10 per cent too low.

Planning and Adjustment Board Appointed for Construction Industry

On June 6 President Roosevelt appointed Sullivan W. Jones impartial chairman of the National Construction Planning and Adjustment Board. The employer-employee tribunal of the construction industry under its NRA code. Mr. Jones, who was industrial adviser for the NRA on the Construction Code prior to his recent activity as chief of staff of the resident advisors of the NRA Industrial Advisory Board was formerly State Architect of New York. He was also the architect of public buildings in Wilmington, Delaware, and of the city halls in Pittsburgh, Pa., Buffalo, N. Y. and Oakland, Calif.

With the announcement of the appointment of the chairman, General Johnson, NRA Administrator, officially approved the ten employer and ten employee members previously selected. The ten employer members were nominated at a meeting of the Construction Code Authority on March 23 and selected by the industrial Advisory Board of the NRA while the ten employee members were selected by the Labor Advisory Board of NRA from nominations made by employee organizations.

The members of the National Planning and Adjustment Board are as follows:

John F. Casey, John F. Casey Co., Pittsburgh (contractor).
E. M. Craig, President, American Construction Council, Chicago.
C. H. Dabelstein, W. F. Dabelstein & Sons, Inc., New York (painting contractor).
Charles R. Gow, Warren Bros. Co., Boston (highway contractor).
Alfred J. Hixon, Hixon Electric Co., Boston (electrical contractor).
John A. Holabird, Holabird & Root, Chicago (architect).
L. J. Horowitz, Thompson-Starrett Co., Inc., New York (building contractor).
Arthur A. Johson, Arthur A. Johnson Corp., Long Island City, N. Y. (contractor).
Redfield Proctor, Vermont Marble Co., Proctor, Vermont.
O. W. Swenson, Foley Bros., Inc., New York (contractor).
M. J. McDonough, President, Building Trades Department, A. F. of L.
John J. Hynes, Sheet Metal Workers International Association.
William L. Hutcheson, President, United Brotherhood of Carpenters and Joiners of America.
M. J. Colleran, President, Operative Plasterers and Cement Finishers International Association.
John Coefield, President, United Association of Journeymen Plumbers & Steam Fitters.
Harry C. Bates, President, Bricklayers, Masons and Plasterers International Union.
L. P. Lindelof, President, Brotherhood of Painters, Decorators and Paperhangers.
D. W. Tracy, President, International Brotherhood of Electrical Workers.
P. J. Morrin, President, International Association of Bridge, Structural and Ornamental Iron Workers.
J. V. Moreschi, President, International Hod Carriers, Building and Common Laborers Union.

The President has suggested that the Board undertake immediately a thorough study of trade jurisdictional disputes, their causes and origins, and methods for their prevention and amicable solution. Mr. Jones, in accepting his appointment as chairman, outlined other activities for possible consideration by the Board, including the problem of stabilizing employment, of promoting comprehensive apprenticeship training programs and of raising the standards of craftsmanship.

The first meeting of the Board will be held June 15 in Washington.

Code applies to materials purchases

With the approval of NRA, the Construction Code Authority under date of June 8 issued interpretation No. 1 of the Code (The Authority has previously issued twenty explanations which under the procedure do not require the approval of NRA, but are issued subject to review by the Administrator. An interpretation is an exposition or answer to a problem as to the true meaning of the Code provisions *as they stand*. Where no such decision is required on which reasonable men, equally well informed, might differ, a ruling is not an interpretation, but merely an explanation).

The Construction Code Authority was asked by the National Terra Cotta Manufacturers Association whether the purchase of terra cotta required in construction would be governed by the provisions of Article VII of Chapter I. It was stated that hand-made architectural terra cotta is always made especially for the particular project, and bids are always lump-sum bids. However, terra cotta manufacturers are bound by the provisions of the Terra Cotta Code, in which there is no provision to prevent them from cutting the original bidding price, while the buyer seemingly is bound by the provisions of the Construction Code as to conditions under which bids may be taken and the award made, including awarding at the original bidding price.

Section 1 (a) of Article VII defines competitive bidding to include comparable proposals to execute a specific program of work, furnish a definite service, or supply a material specifically required for a particular project at a stipulated price. In view of this, the interpretation has been made that where a method of competitive bidding is adopted, the provisions of Article VII apply to the purchasing of material as well as to services.

This intrepretation is of considerable importance in clarifying the situation as to relations between members of the Construction Industry and other industries which supply it with material. It indicates that whenever competitive bids under the regulations of the Code are asked, the award must be made at the original bidding price, even though the seller may be under another code which permits him to cut his initial price. It results, practically, in extending the benefits of competitive bidding conditions to vendors where prices are obtained by competitive bidding. This interpretation should be considered along with the provisions of explanation No. 9 (*ENR*, June 7, 1934, page 753), referring to furnishing quotations on standard products.

Agreement on River and Harbor Code

It is understood that an agreement was reached recently between representatives of the River and Harbor Improvement Association and of the Divisional Code Authority for General Contractors as to the line of demarcation of construction work coming under the River and Harbor Improvement separate Code and Chapter II, the General Contractor's division of the Construction Code. The River and Harbor Improvement Code was approved by the President on May 18 (*ENR* May 24, p. 676) and becomes effective June 17. Immediately thereupon, the Construction Code Authority and General Contractor's Divisional Code Authority petitioned for a stay of the application of this code for members of the construction industry, claiming that the definition conflicted and overlapped with the functions in certain divisions and sub-divisions of the Construction Code and interfered with the establishment of proper coordination within the construction industry.

As a result of the conference, the definition in the River and Harbor Improvement Code was to be confined to dredging, submarine rock removal, land reclamation by dredging and marine and subaqueous work in rivers, harbors and waterways when done principally by marine plant and the crews thereof, and including operations with respect to new projects, maintenance projects or improvement projects. These same activities are to be excluded from the definition of Sub-Chapter II-B for Heavy Construction and Railroad Contracting Division of the General Contractor's Divisional Chapter proposed at public hearing on May 21 and now pending approval.

Texas Communities Apply for Additional PWA Loans

Additional applications for PWA loans and grants totaling $8,384,604 have been forwarded to Washington from the regional office at Fort Worth, Texas. Not all of these applications have been approved by the regional authorities. These applications, together with those previously submitted to Washington by the Fort Worth office, give a grand total of $110,720,226 for the State. Most of the proposed projects are small school buildings and other public building projects. Several large projects are listed, including a municipal gas system at Lubbock, $1,300,000; a municipal electric power plant at Fort Worth, $2,228,000; a hospital for Houston and Harris Counties, $1,500,000; and a retail market for San Antonio, $721,914.

Army's PWA Construction Is 90 Per Cent Under Contract

The Army's $61,000,000 construction program, financed by PWA, is being pushed by the Quartermaster Corps at high speed and is giving work to thousands of men at widely separated points, according to a report made recently by Secretary of War George H. Dern. More than 800 contracts have been awarded, which together with bids advertised and force account work under way, represents more than 90 per cent of the entire allotment. To date $17,785,205 has actually been expended on the program, of which $6,225,690 went to labor on the job. Employment at present involves 18,655 men working on the job and an estimated 23,600 employed indirectly. Employment will increase to a peak within two or three months. The contracts are spread over 64 army posts and reservations. In addition to the construction funds the PWA allotted the Quartermaster Corps $10,000,000 for motorization and $592,161 for national cemeteries.

Various Universities Award Honorary Degrees to Engineers

Four civil engineers have been designated as recipients of honorary degrees at current commencements by four universities, scattered from coast to coast. One of the recipients received a degree of Doctor of Laws, two Doctor of Engineering, and the fourth Doctor of Science.

Elwood Mead

Elwood Mead, commissioner, Bureau of Reclamation, was honored June 4 by the University of Wyoming, Laramie, as a Doctor in Law. In 1925 he was awarded a similar degree by the University of Michigan. In conferring the degree the University of Wyoming recognized the service Dr. Mead rendered that state in 1888, and subsequent years, as state engineer in reorganizing the settlement of water rights on the irrigation projects and writing the state irrigation law.

C. B. McCullough

Conde Balcom McCullough, bridge engineer and assistant State Highway Engineer for the Oregon State Highway Commission, received the honorary degree of Doctor of Engineering from the Oregon State College at Corvallis on June 4. Mr. McCullough has been connected with the Oregon State Highway Commission as bridge engineer since 1919, and in 1932 became assistant highway engineer.

J. L. Savage

John L. Savage, chief designing engineer of the United States Bureau of Reclamation, will be awarded a degree of Doctor of Science on June 18 by the University of Wisconsin.

Robins Fleming

Robins Fleming, civil engineer and author, was awarded the honorary degree of Doctor of Engineering by his alma mater, Lafayette College, at the 99th commencement exercises held at Easton, Pa., June 8. Mr. Fleming was with the American Bridge Co. from 1900 to his retirement in 1931.

Florida Planning Board Discusses State Problems at First Meeting

Questions of state highways, taxation, public health, land use and conservation, public works, parks and playgrounds and other state problems were discussed by the Florida Advisory and Planning Board at a meeting held at Jacksonville, May 28-29. The meeting was the first held since the board was enlarged to include the State Planning Board, appointed last December. A program for maintaining county roads, a state-wide traffic survey, and a complete study of a gradually developed highway system for the state was outlined by C. H. Overman. A nine-point health program, prepared by Dr. Henry H. Hanson, state health officer, was read before the meeting. C. H. Reeder, Miami, advocated a board of centralized control over all state institutions. An advisory engineer to the board will be selected by a committee headed by C. B. Treadway, chairman of the board. The committee will recommend the name of an engineer for employment out of funds supplied by the National Planning and Advisory Board.

Two Million Cu.Yd. Concrete Placed at Boulder Dam

Concrete yardage placed by Six Companies, Inc., in Boulder Dam passed the two million mark last week, just exactly one year after the start of concrete operations in the dam. A million yards of concrete has been placed in the last five months, an average of 200,000 cu.yd. per month. Another million yards will be placed in the next six months, according to present schedule. Present crest elevation is 404 ft. above foundations. Crest width is now 250 ft., as compared with 650 ft. at the foundation line. At the present crest Black Canyon is 650 ft. wide.

Minimum Wage Rates Proposed For Engineers and Assistants

Minimum wage rates for engineers and for engineering assistants are proposed in a report of the committee on fees and salaries of the New York County Chapter, New York State Society of Professional Engineers approved by the Chapter at its regular meeting on May 23. Subsequently the Kings County Chapter, another large chapter of the society, gave its endorsement to the proposal.

Only two minimum rates would be set up under the committee's proposal. They are as follows:

1. For the lowest grade of subprofessional engineering work the minimum pay should be $100 a month for a man who has an engineering degree.

2. For the lowest grade of professional engineering work requiring a man with the qualifications of a licensed professional engineer, the minimum pay should be $200 a month.

Louisiana Appeals Decision Ordering Payment to New Orleans

Appeal to the Louisiana Supreme Court from a decision of the district court of Baton Rouge, enjoining the Louisiana Highway Commission from expenditure of any of its funds until a judgment of $175,000 to the City of New Orleans has been paid, has been filed by Attorney General Gaston Porterie. The district court, in a suit brought by the city, had rendered a decision subsequently upheld by the state supreme court, directing the Louisiana Highway Commission to pay to the city $175,000 allegedly due April 1 as the quarterly payment under the provisions of a constitutional amendment under which a total of $700,000 is to be paid the city.

The previous litigation was between the Louisiana Highway Commission and the City, acting through the city attorney. Upon filing of an action asking enjoining of the Commission's disbursing any of its funds until the district court judgment was paid, the Attorney General intervened for the State. The Attorney General filed a motion to introduce evidence to show that estoppal of disbursement of funds by the Commission would cause that agency to cease activity; to show that the highway commission is unable to make payment; and to show the city had been overpaid in disbursement to it by the Commission of $2,100,000 up to December 31, 1933. The district court overruled the motion on the grounds that the time had passed for the introduction of such evidence.

Brief News

VOTERS of Wenatchee, Wash., recently approved a $1,000,000 project for improving the water supply system of the city. The project will be partly financed by PWA funds.

WORK OF REALIGNING the Bear Creek canyon road between Morrison and Starbuck, Colo., destroyed by a cloudburst flood last summer, is under way by the state highway department.

DALLAS, TEXAS, CITY OFFICIALS have asked the PWA to finance a $476,200 program of sewer construction by substituting a storm sewer program for a list of proposed water improvements that will not be carried out immediately.

ANY TWO OR MORE municipalities in New York may jointly create a garbage and refuse district for the collection of waste materials, a law to this effect being recently enacted by the New York legislature.

PURCHASE by the PWA of $303,000 in bonds of four Oklahoma cities will enable construction operations in these towns to begin within 30 days. The projects include: Cleveland, $150,000, waterworks; Nowata, $16,000, waterworks; Clinton, $115,000, high school.

THE IMMEDIATE NEED for water and sewer improvements in this country aggregates $1,019,993,740, according to testimony of H. C. Delzell, of the American Water Works Association, before a subcommittee of the Senate. The figures are purported to have been obtained from health officials and fire underwriters.

CONSTRUCTION OF A SEWAGE TREATMENT plant for exclusive use of the packing plants at the southwest edge of the city has been recommended by the city officials of Oklahoma City, Okla. The plant is considered necessary because of the disintegration of the principal sewer line serving Packingtown and overloading the south side sewage disposal plant.

SALT LAKE CITY will spend $100,000 drilling ten wells to avert a city water shortage this summer. The wells are expected to yield 50 sec.-ft. of water which, supplementing the minimum of 36.5 sec.-ft. expected from the present stream flow source of supply, will give the city the 50-sec.ft. necessary to meet minimum requirements.

THE WHITE RIVER POWER CO. has submitted an amendment application for a license covering its project on the White River in Arkansas and Missouri. Three dams are to be substituted for one high dam as proposed in the original application. Under the amended plan there is to be a dam creating a 79-ft. head at Wild Cat Bend; another creating a 52-ft. head at Bull Shoals and a third creating an 82-ft. head at Hog Thief. It is proposed to install 159,000 hp.

THE WESTERN COLORADO Protective Association has been incorporated with headquarters at Grand Junction for the purpose of conserving and protecting from diversion from the western to the eastern slope waters of western Colorado rivers. Two such diversion projects are already under construction, the Moffat tunnel project for the city of Denver and the Ordway irrigation project. Other diversion projects under the Continental Divide have long been advocated.

AWWA Objects to Code for Municipal Water Utilities

At its 54th annual convention in New York City June 4 to 8, the American Water Works Association expressed its disapproval of a proposal to have the municipal water utilities join with the privately owned water companies under a code of fair competition. Among the numerous objections cited to such a plan was the fact that is would involve discrimination between the employees of municipal water departments and other departments of the municipal government. Further, it could not be clearly seen how such codification would result in any benefit in waterworks operation. Deputy Administrator Peebles, who attended the meeting, explained that any action on the part of municipal utilities in coming under a code would have to be entirely voluntary.

The Board of Direction of the Association decided to merge the activities of the Waterworks Committee for Trade Recovery with that of the Construction League of the United States. This means that the American Water Works Associaton will discontinue the maintenance of a separate office for the purpose of promoting investment in public works. The Trade Recovery Committee's activities have resulted in the collection of a great amount of data of a number of projects of a sanitary engineering nature awaiting construction and have been instrumental in the spreading of information regarding them.

In accordance with another decision made by the Board of Direction the Association hereafter will demand of convention hotels definite assurance that plumbing systems adequately protect the purity of the drinking water supply. This action followed the detailed discussion in the convention of the faulty piping system in the basement of the hotel in Chicago on which the epidemic of amebic dysentery focussed last year.

During the last session of the convention the presidency was assumed by Harry E. Jordan, of the Indianapolis Water Co. Mr. Jordan succeeds Malcolm Pirnie, consulting enegineer of New York City.

Engineers Favor Mortgage Reform

As the result of a thorough committee study of the mortgage money market and its bearing on new construction work, the New York County Chapter of the New York State Society of Professional Engineers has recommended to the Government mortgage reform including five major points: (1) A grant of mortgages on new construction to individuals or corporations; (2) re-discount of mortgages on new construction; (3) encouragement of private building construction; (4) provision of means to pass on the desirability and social usefulness of this construction; and (5) recognition of the principle that the need for new construction should be measured not by present conditions of stagnation but by the expectation of trade revival.

In its statement the Chapter expresses the view that prosperity requires a revival of the construction industry. It has appointed a permanent committee to deal with the subject of construction revival.

C. E. Grunsky, Prominent Engineer, Dies in San Francisco

Carl Ewald Grunsky, prominent consulting engineer of San Francisco, and past president of the American Society of Civil Engineers, died in San Francisco, June 9, at the age of 79. He was born April 4, 1865, in San Joaquin County, Calif. His early education was secured in Stockton High School, and his technical education

Carl Ewald Grunsky

for the most part was secured in Germany. He was graduated from the Polytechnicum at Stuttgart in 1877. The same institution granted him a doctorate in engineering in 1910. Returning to his native state, he was employed in the state engineering department of California from 1878 to 1888, successively as topographer, assistant and chief assistant state engineer.

He first entered private practice in 1886 in Sacramento. Later he moved his offices to San Francisco, continuing his practice there until 1899. Elected city engineer of San Francisco in 1900, Mr. Grunsky served for four years. At the expiration of his term he was made a member of the Isthmian Canal Commission, serving for a year. From 1905 to 1907 he was consulting engineer for the U. S. Reclamation Service and advisor to the Secretary of the Interior. From 1908 to the time of his death he maintained consulting offices in San Francisco.

In connection with his private practice, Mr. Grunsky was consulting engineer for the Imperial Irrigation District, the Sacramento Public Utility District, the East Bay Municipal Utility District, and the Santa Clara Water Conservancy District.

Mr. Grunsky was for long identified with engineering society activities. He became a member of the American Society of Civil Engineers in 1898, and was elected a director 1919-1921, vice-president 1922-1923, and president, 1924. He was a recipient of the society's Norman Medal in 1910. As president of the California Academy of Science, he aided in the establishment of a museum and auditorium at Golden Gate Park in San Francisco. He was president of the American Engineering Council in 1930. Former President Hoover appointed him a member of the national organization for unemployment relief. In 1924 Rensselaer Polytechnic Institute honored him with the degree of Doctor of Engineering. All through his technical career Mr. Grunsky contributed frequently to the technical press and published several books in his lifetime.

Obituary

HENRY NIEMEYER, contractor and builder of Seymour, Ind., died at his home in that city June 7, at the age of 75.

EMIL NEUBLING, former water works engineer of Reading, Pa., and later city engineer, died last week in that city.

OSCAR R. RABENNECK, superintendent of Washington County, Ill., highway department, and county engineer, died at his home at Nashville, Ill., recently.

WM. J. BRINE, building contractor of St. Louis, died June 6, in that city, at the age of 67, of pneumonia following blood poisoning resulting from a scratch on his hand.

DR. ROBERT WALLACE HARDEN, formerly a civil engineer on the staff of the Louisville, Evansville & St. Louis Railroad, and later a prominent Chicago surgeon, died recently in Chicago at the age of 74.

FRANK L. MCLAUGHLIN, of Forest Hills, N. Y., died in that city April 14, at the age of 52. From 1913 to 1929 he was general superintendent for the Foundation Company. At the time of his death he was employed as supervising engineer for the PWA at Woodside, Long Island.

CARLTON C. ALLEN, 49, a member of the Huntington, W. Va., U. S. Engineer Office since 1922, died in a hospital in that city June 6. Mr. Allen at one time was with the Wheeling office of the U. S. Engineers. He was soon to have been placed in charge of the operations section of the Huntington district.

JOHN C. DILLON, 71, chairman of the state advisory board of the PWA, New York State, and prominently identified with manufacturing and engineering enterprises in Buffalo, died in New York City June 2. Mr. Dillon founded the Titusville Forge Co., Titusville, Pa.; Bridgeport Forge & Iron Co., Bridgeport, Conn.; Delaney Forge and Iron Co., Buffalo, and the Lake Erie Engineering Co., Buffalo.

ROSS E. ALVERSON, county engineer of Snohomish County, Calif., since 1922, died at his home in Everett, Calif., June 5. Prior to his election as county engineer, Mr. Alverson was connected with the construction of the Everett pipe line from the Sultan River, and with county highway work. Following his return from overseas in 1919, he served one year as city engineer at Sedro-Woolley, Calif., and then engaged in consulting engineering with Henry Zimmerman, later leaving the firm to take over the office of county engineer.

MAJOR J. E. PRICE, chief of the Veterans' Administration construction service, died June 3, in Mount Alto Hospital, Washington, at the age of 57. Major Price, who served in the World War as a captain in the Engineer Corps, was in charge of all construction, maintenance and operation of all administration hospitals and soldiers' homes. He entered the government service about 30 years ago as superintendent of construction in the office of the supervising architect, and was taken into the Veterans' Administration when that agency was created.

H. GREIG VEEDER, JR., assistant manager of erection for McClintic-Marshall Corp. and nephew of C. D. Marshall, was killed June 11 when an airplane in which

he was flying from Buenos Aires to Santiago crashed near Junin, Argentina. Mr. Veeder had just completed a six-months job of erecting 150 oil-storage tanks in Buenos Aires and was returning to the United States. Graduating from Cornell in 1925, Mr. Veeder immediately entered the erection department of McClintic-Marshall, where for six years he was in the structural division, working on the Mt. Hope suspension bridge and the Burlington-Bristol lift bridge among others. Two years ago he was transferred to the plate division of the company.

JOHN WALTER PEARSON, for 50 years a civil engineer with the New York, New Haven & Hartford Railroad, with headquarters at Boston, died on June 6 at his home in Newton, Mass. He was born in Webster, N. H., in 1862, and was graduated from Dartmouth College in 1883. After leaving college he became assistant to the chief engineer of the then Old Colony Railroad in Boston, later becoming division engineer on the New Haven. He took an active part in the pioneer electrification of the Nantasket Beach branch and in the building of the South Station at Boston, and also devoted much time to expert engineering service in court cases.

WILLIAM GORE, senior member of the firm of Gore, Nasmith & Storrie, consulting engineers, Toronto, died at his home in that city June 6, at the age of 64. He was internationally known in the waterworks field, and was consultant on many waterworks installations in England and Canada. Born at King's Lynn, Norfolk, England he studied at King's Lynn Technical School, and the City and Guilds Institution of London, graduating from the latter institution in 1896. In 1912 he joined the Ransome-Van Mehr Machinery Co. of London, and invented the Ransome drifting sand filter for water supply purification. The first drifting sand filter was installed at Merthyr Tydfil, Wales, about 1913. In 1915 a drifting sand filter plant was installed at Toronto with a capacity of 72 m.g.d. Later this type of filter was placed in operation in several cities in Canada. Mr. Gore was engineer on numerous large-sized standard mechanical filter plants in Canada, notably those at Ottawa and Calgary.

SOCIETY CALENDAR

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, annual meeting at Cornell University, Ithaca, N. Y.; conferences, June 19-21, regular meetings June 21-23.

AMERICAN SOCIETY FOR TESTING MATERIALS, Atlantic City, N. J., June 25-29, 1934.

AMERICAN SOCIETY OF CIVIL ENGINEERS, annual convention, Vancouver, B. C., Canada, July 11-14.

INTERNATIONAL CITY MANAGERS ASSOCIATION, annual conference, St. Louis, Oct. 15-17.

NEW YORK STATE SEWAGE WORKS ASSOCIATION, spring meeting, Jamestown, N. Y., June 15-16.

AMERICAN SHORE AND BEACH PRESERVATION ASSOCIATION, annual mid-year conference, Hampton Beach, N. H., June 18-10.

CONNECTICUT SOCIETY OF CIVIL ENGINEERS, New Haven, will hold a joint meeting and inspection with the Connecticut Section, A.S.C.E., June 26, at Woodville and Goshen, Conn.

CONSTRUCTION STATISTICS OF THE WEEK

A DROP in all classes of public works contracts this week is only partially offset by an increase in private awards. The figures are, public works $14,581,000, of which $2,720,000 is federal and $11,861,000 state and municipal. While these are below the average week this year they are well ahead of last year. Private awards at $4,433,000 are almost double last week and only slightly under the average week to date.

Industrial buildings are higher at $2,122,000 than for any week since April 5. Streets and roads are down to $5,362,000; earthwork, irrigation, and drainage is down to $2,246,000 and public buildings to $2,854,000.

Large contracts include a glue factory in Massachusetts, $500,000; highway lettings by Tennessee, $689,000, and by Massachusetts, $951,000; bridge awards by Arkansas, $400,000; excavation at Fort Peck Dam, $1,292,000; steel rails for the A. T. and S.F.R.R., $1,183,000; and Contract 3 high speed transit line across Delaware River bridge, Camden, N. J., $958,000.

New capital this week makes a net gain of $5,572,000 after PWA net decreases in allotments have been deducted. State and municipal bond sales for construction total $7,325,000 for the week and two corporate issues for brewery extensions and additions, total $655,000.

CONTRACTS
(Thousands of Dollars)

	Weekly Average June 1933	Week Prev. 4 Weeks	Week June 14 1934
Federal Government	$ 562	$5,423	$2,720
State and municipal	9,402	17,914	11,861
Total public	$9,964	$23,337	$14,581
Total private	10,871	4,696	4,433
Week's total	$20,836	$23,337	$14,581
Cumulative to date: 1933	$393,397	1934	$580,196

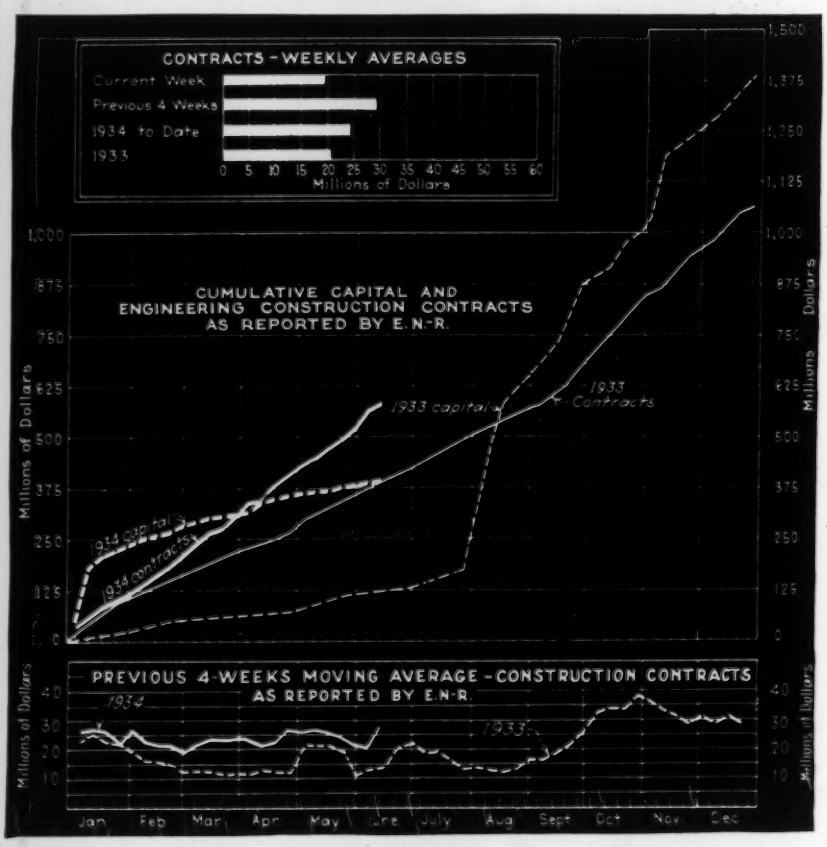
NEW PRODUCTIVE CAPITAL
(Thousands of Dollars)

1934	Week June 14	Cumulative
State and municipal	$7,325	$142,204
PWA allottments, S&M	2,398	182,705
RFC loans, S&M		1,349
Corporate issues	665	15,197
PWA allotments, private		50,417
Total, Non Federal	$5,572	$391,872
PWA allotments Federal Constr.	17	49,468
Total new capital	$5,599	$441,350
Cumulative to date: 1933	$136,387	1934 $391,872

NOTE: These figures include private bonds, and stocks sold for productive purposes; state and municipal bonds for construction; PWA loans and grants to states and municipalities, including the special highway funds; PWA private loans, and allotments for Federal construction.

INDEX NUMBER

E.N.-R.-Cost	1913 = 100	1926 = 100	E.N.-R.-Volume	1913 = 100	1926 = 100
June, 1934	**199.61**	95.95	**May, 1934**	**101**	44
May, 1934	199.61	95.95	April, 1934	109	48
June, 1933	163.41	79.02	May, 1933	103	45
1933 (Av.)	170.18	81.80	1933 (Av.)	102	45
1932 (Av.)	156.97	75.45	1932 (Av.)	127	56
1931 (Av.)	181.35	87.17	1931 (Av.)	220	96.5


CONTRACTS - WEEKLY AVERAGES
Current Week
Previous 4 Weeks
1934 to Date
1933
0 5 10 15 20 25 30 35 40 45 50 55 60
Millions of Dollars
CUMULATIVE CAPITAL AND ENGINEERING CONSTRUCTION CONTRACTS AS REPORTED BY E.N.-R.
1933 capital
1933 Contracts
1934 capital
1934 contracts
Millions of Dollars
PREVIOUS 4-WEEKS MOVING AVERAGE - CONSTRUCTION CONTRACTS AS REPORTED BY E.N.-R.
1934
1933
Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec